AMERICAN MACHINIST

JANUARY 7, 1943

ARMAMENT SECTION: Forging Shell Bodies—Page 93

IN 1943 More Precision Faster

with HEALD PRECISION BORING AND GRINDING MACHINES

Building the huge quantities of planes, tanks, guns and ships needed today calls for speed and precision in manufacturing — speed to get vital material quickly to fighting fronts, and precision to insure dependable fighting service.

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THE HEALD MACHINE CO., Worcester, Mass., U. S.

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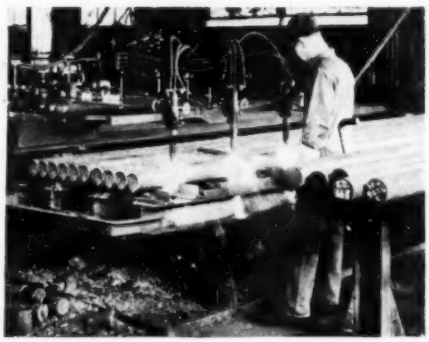
AMERICAN MACHINIST

January 7, 1943



Forged Shells—Accurate tooling for presses and close inspection hold rejects below 0.5 percent of output

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VOLUME 87 NUMBER 1

AMERICAN MACHINIST. Copyright 1942 by McGraw-Hill Publishing Co., Inc. Published every other Thursday, price 35c. a copy. Allow ten days for change of address. Address all communications about subscriptions to the Director of Circulation, American Machinist, 330 West 42 Street, New York, N. Y. Subscription rates — United States, Canada, Mexico and Central and South American countries, $5.00 a year, $8.00 for two years, $10.00 for three years. All other countries $8.00 a year, $13.00 for two years, $16.00 for three years. Entered as second class matter, September 29, 1936, at Post Office, Albany, N. Y., under the act of March 3, 1879. Printed in U.S.A. Cable address "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

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PRINTED IN U. S. A.

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Tech

Help . . .

COMING NEXT ISSUE

- - for men with procurement problems

● *January 21* brings you the latest news on what and where to buy in Metal-Working—in the huge, up-to-the-minute 30th Annual Review & Catalog Number of *American Machinist*.

What's New in the Markets

Here is a complete summary of new equipment, materials and parts introduced to Metal-Working and described in *American Machinist* during 1942—more than 1,000 items with descriptions and illustrations . . . include alternate possibilities for products difficult to secure.

Live Sources of Supply and Service

Here you will find last-minute directory listings of more than 6,000 companies now actively engaged in supplying Metal-Working; also *American Machinist's* list of companies which have recently indicated that they have facilities for doing contract work.

Reference Advertising, Too

Especially for this issue, advertisers have recast their copy to convey, in brief catalog style, the maximum information on the type and utility of products which they can supply.

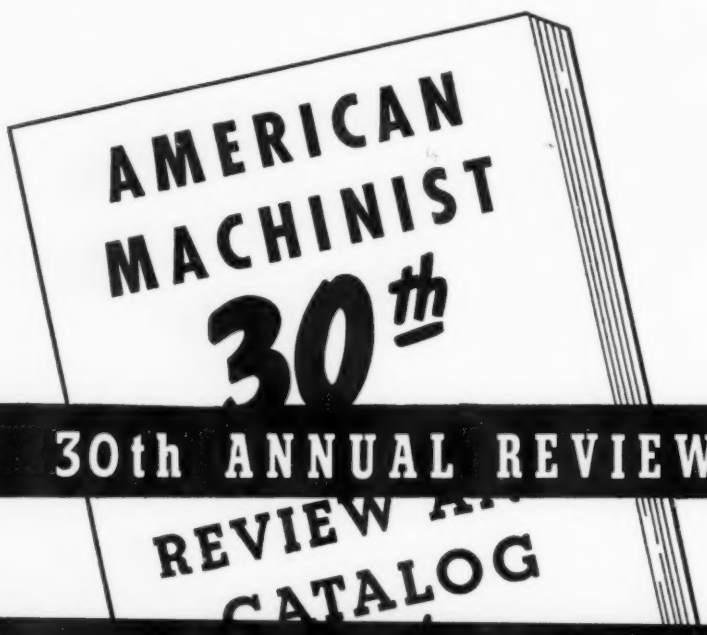
For Daily Use All Year

Both the editorial and advertising pages in this issue are classified as follows: 1. Machine Tools; 2. Tools and Accessories; 3. Forming Equipment; 4. Heat-Treating, Welding, Cleaning and Finishing; 5. Plant Service Equipment; 6. Parts and Materials. The sections are separated for ready reference by special markers.

Your 1943 Buyers' Reference

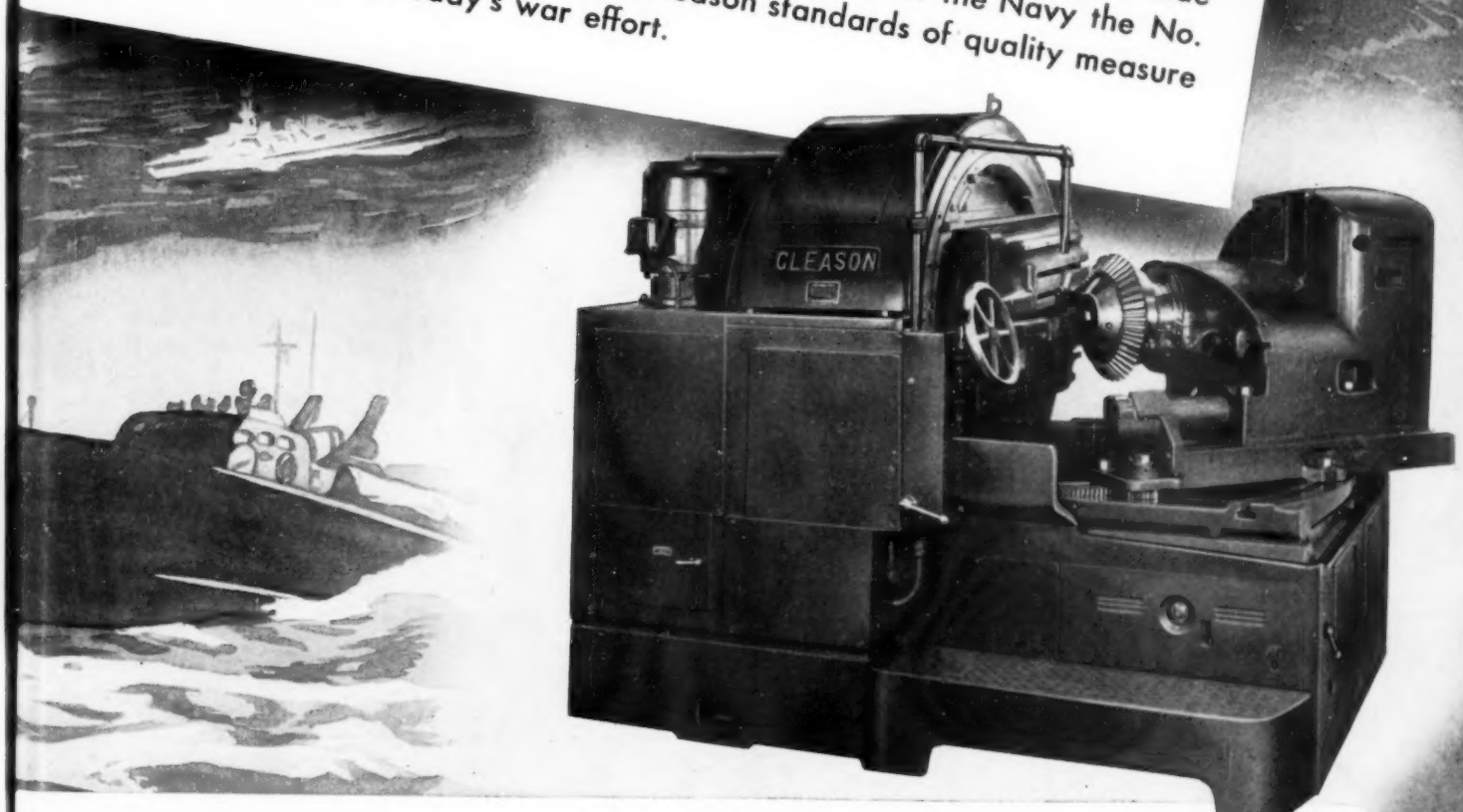
Time and money spent looking for materials, equipment, and parts can be saved when the answer to your procurement problem is in this coming issue. Keep it on your desk within arm's reach for use during 1943 . . . your copy of the 30th Annual Review & Catalog Number.

January 21st, 1943



30th ANNUAL REVIEW & CATALOG NUMBER

HEAVY-DUTY SERVICE . . . is the keynote of our Navy's action, and back of the ships must be machines designed for equally arduous work. That is why the **No. 24 GENERATOR** is found on Navy projects throughout the country. A completely universal machine for cutting a wide variety of straight bevel gears, it combines the qualities of versatility, high production, and wide capacity. In production, maintenance, and repair work for the Navy the No. 24 is proving how the long-established Gleason standards of quality measure up to the demands of today's war effort.



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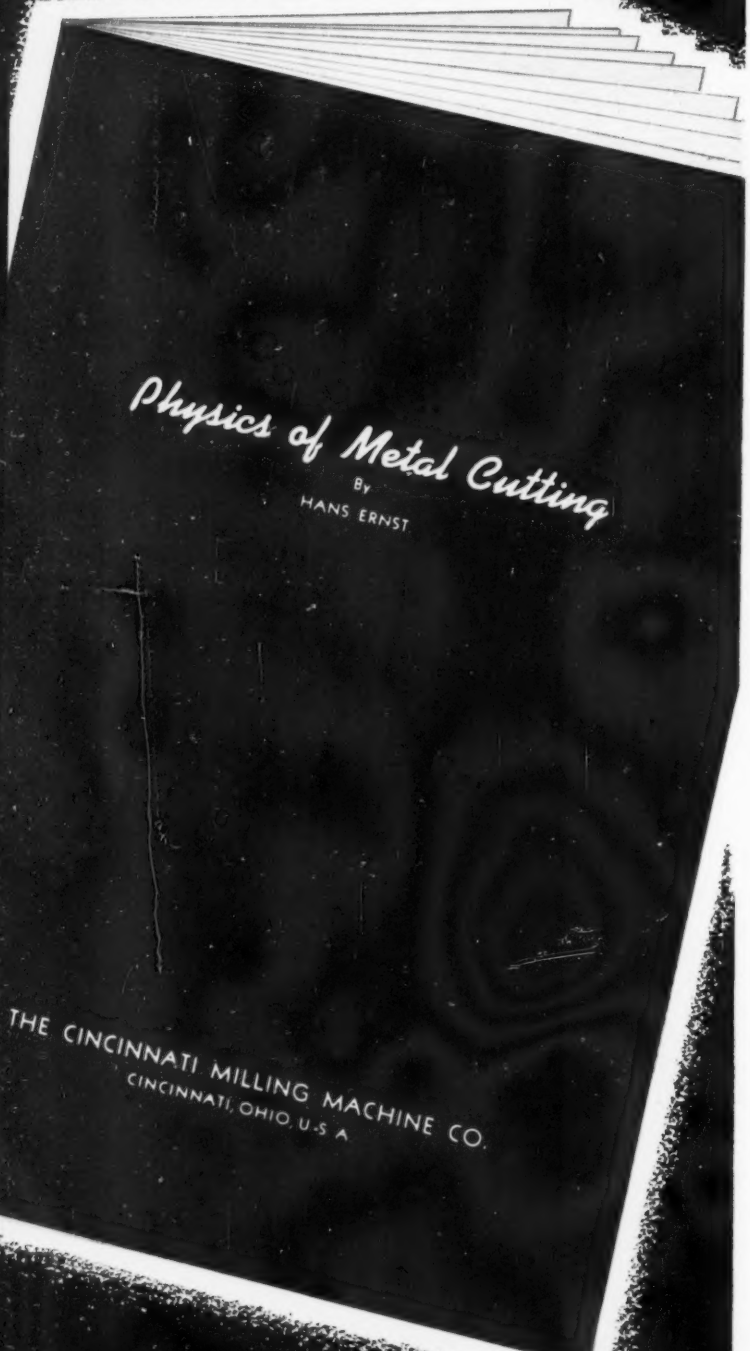


PAGES FROM THI

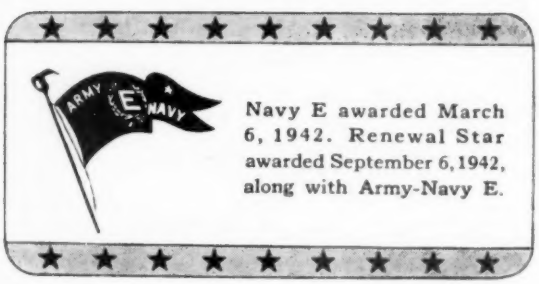
8 PHYSICS OF METAL CUTTING

Fig. 7.—Stress Distribution in Photoelastic Material When Indented by a "Knife Edge" Punch.

we may readily observe the flow of material escaping along the trajectories leading from the advancing tool point toward the free space above.

This upward movement along the tool face (or lateral escape of compressed material) is the type of flow which must first take place when the cutting tool engages the work piece. As the tool continues to advance, opposition to the upward

What takes p



Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

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TOOL ROOM AND MANUFACTURING MILLING

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FROM THIS INTERESTING BOOKLET

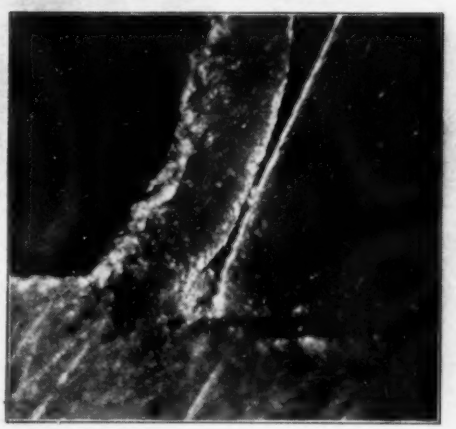


Fig. 18—Formation of Type 2 Chip (Continuous Chip, With Built-Up Edge Adjacent to the Tool Face). Material: S.A.E. 3115 Steel. Depth of Cut 0.010 Inch. Rake Angle 23 Degrees. Temperature 72 Degrees Fahr. Cutting Speed 30 Inches/Minute. No Cutting Fluid Used.

the workpiece, thus each increment of advance of the latter causes an additional piling up of compressed material in this region, the crystalline grains of the material being elongated here in a direction substantially parallel to the tool face.

As the stationary pile of compressed material (or built-up edge) becomes larger and larger, the line of shear between itself and the chip body on the one side, and the workpiece on the other, moves farther and farther away from the cutting edge. Thus, as the built-up edge increases in size, it also becomes more and more unstable; eventually a point is reached where failure occurs, and fragments thereof are torn off and escape both with chip and with workpiece. Typical examples

tetrachloride were applied between the chip and tool face. The effect was instantaneous. As shown at (b) the chip formation changed abruptly from Type 3 to Type 2, the built-up edge passing off with the chip, and the finished surface therefore becoming smooth and bright due to the absence of frag-

Fig. 23a—Effect of Cutting Fluid on Chip Formation. Material: Aluminum Alloy; Al 99.3 Per Cent, Si 0.4 Per Cent, Fe 0.3 Per Cent; Depth of Cut 0.010 Inch, Rake Angle 35 Degrees, Temperature —72 Degrees Fahr., Cutting Speed 3 Inches/Minute. Without Cutting Fluid.

Fig. 23b—Effect of Cutting Fluid on Chip Formation. Material: Aluminum Alloy; Al 99.3 Per Cent, Si 0.4 Per Cent, Fe 0.3 Per Cent, Depth of Cut 0.010 Inch, Rake Angle 35 Degrees, Temperature —72 Degrees Fahr., Cutting Speed 3 Inches/Minute. With Carbon Tetrachloride.

ments. It should be noted here that the carbon tetrachloride—which could scarcely be classed as a good lubricant—was found to be extremely effective in reducing the adhesion between chip and tool, hence its action in this case must differ from that which is normally associated with lubrication.

s place at the CUTTING EDGE?

The more man knows about a given subject, the faster he progresses. So it is with metal cutting. Over the past few hundred years he has learned to use metal cutting tools without really knowing how they work. He has learned a lot about speeds and feeds. But, to meet the demands of war production for increased output and higher quality of finish, it is an advantage to know what takes place at the cutting edge.

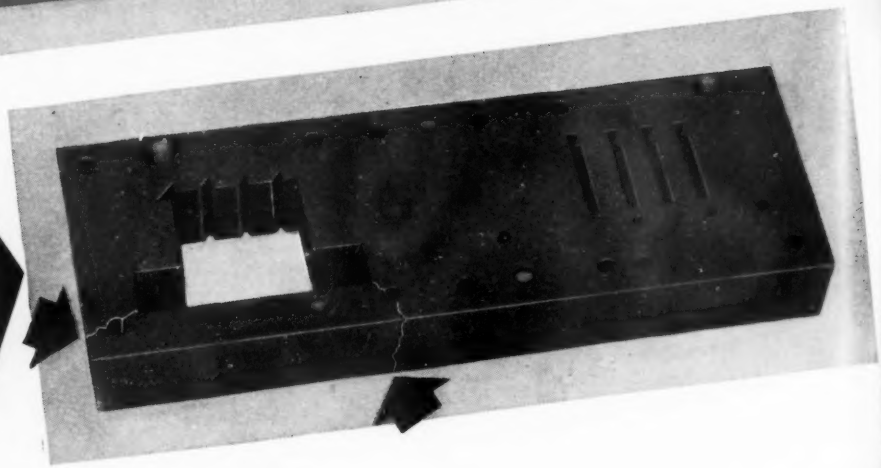
"Physics of Metal Cutting," illustrated at left with specimen pages above, gives this information. This booklet is another official communique from Milling Headquarters—a further contribution to the science of metal cutting by the Research Department of The Cincinnati Milling Machine Co. A copy of this informative booklet will be sent on request. When writing please be sure to ask for booklet No. M-825.

TMILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

URINGILLING MACHINES • SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

One Minute THIS—

Next Minute PING!



There goes 42 hours of Tool Making Time!

CRACKED IN HARDENING! What might have been a good tool is now a piece of scrap. Over a week of skilled tool making time thrown overboard. Now another week must go into the making of a new tool! *Why did the tool crack? What was wrong?* A number of things might contribute to tool failure, causing cracking in hardening. But the trouble may often be traced to some oversight of the relation of tool design to heat treatment.

Look for the Answer in "Tool Steel Simplified"

This subject of the relation of tool design to heat treatment is discussed in Chapter 12 of "Tool Steel Simplified". Here is *practical* information giving actual examples of designs that have caused trouble—and showing how they could have been avoided or corrected.

More than 32,200 copies of "Tool Steel Simplified" are now in use—really used in several thousand plants like yours to "upgrade" men—save time—"trouble shoot"—get better results.

And this is only one of many subjects on which "Tool Steel Simplified" provides helpful information. It contains the kind of "how to" material you can use yourself and the kind you will want your toolroom men to have. Tool steel selection, tool making, heat treating, quenching, furnace atmospheres, "trouble shooting"—all are covered, in easy-to-understand shop language.

As an example of how *practical* "Tool Steel Simplified" is... how *useful* it can be... see the information on the relation of tool design to heat treatment given on the opposite page. It was extracted from Chapter 12.

The Carpenter Steel Company, 109 Bern St., Reading, Pa.

The Standard Tool Steels of Industry

How Tool Shapes can cause hardening hazards

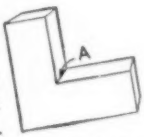
In designing a tool many things require consideration. The following suggestions are concerned only with tool design as it affects the heat treating operation—and through the heat treatment, the serviceability of the tool. They are based on experience, and are given to help bring about a better mutual understanding between the designer and the steel treater, so that designs which may cause cracking or distorting during heat treating can be avoided.

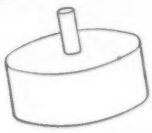
Heat treated steel has a certain strength depending upon the analysis of the steel, the quality of the metal, and the heat treatment which it has received. Sometimes just the internal strains set up in heat treating exceed the strength of the metal, and the tool cracks before it ever sees service. Or, if you get the tool through the hardening process safely, it may be so weakened that it will fail in service under relatively light loads.

Internal strains arise from many causes, but the most serious are those developed during quenching, by reason of differential cooling of sections of the tool that are of markedly different size or mass. Thus, the differential cooling that causes internal stresses is largely controlled by the size and shape of the piece being quenched. In other words, its design.

It is desirable where possible to plan shapes so that the entire tool may be heated and cooled at approximately the same rate.

The angled shape here suggests a condition that tool designers try to avoid. Such sharp re-entrant angles as the one at "A" are objectionable because it is impossible to get uniform cooling there and internal strains are set up right at a point where service stresses will be concentrated.





This shape illustrates a light section adjoining a very heavy section—another condition that tool designers do not advise. It would be practically impossible to harden such a shape in water without cracking at the sharp corner. Even in oil, it would be difficult to quench safely.

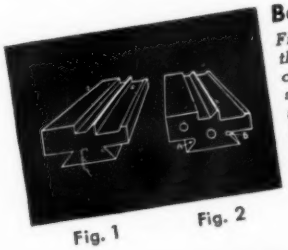


Fig. 1 Fig. 2

Balance of cross-section

Figure 1 shows an under-cutting form-tool that would be hazardous to harden because it is made up of heavy and light sections joined by sharp angles. Figure 2 shows an improved design. Holes have been drilled through the two heaviest sections to balance the weight of metal. Also notice at "A" and "B" two suggested treatments to avoid the sharp angle at the base of the dovetail.

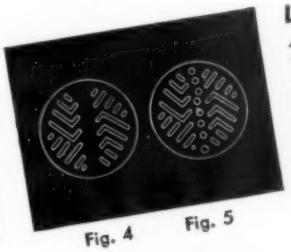


Fig. 4 Fig. 5

Less metal needed here

Another condition that often causes warping is shown in Figure 4. The heavy rib through the center tends to prevent shrinkage and would cause the die to become oval in quenching. Drilling holes, as in Figure 5, helps overcome the difficulty.

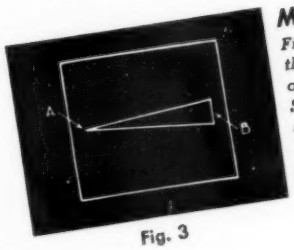


Fig. 3

More metal needed here

Figure 3 is a blanking die (oil hardening) that failed in service. It was made from approximately a 3" x 2¾" x ½" section. Stresses set up in heat treatment and in service concentrated at points "A" and "B". A slightly larger section; 3½" x 2¾" x ¾" could have eliminated failure.

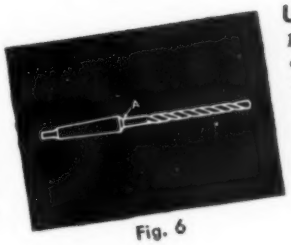


Fig. 6

Use generous fillets

Figure 6 illustrates a design for twist drills that gave considerable trouble in service by breaking at "A". When a more generous fillet was allowed at this point, the trouble was eliminated and satisfactory results were obtained.

"Tool Steel Simplified"
315 pages
205 illustrations
Available at cost in the U.S.A.—$1.00 a copy. ($3.50 elsewhere)

These are only a few tips from one *subject* covered in "Tool Steel Simplified". Get the benefit of *all* the useful information the book contains . . . make copies available to the toolroom men you want to train—to your "trouble shooters". Order as many copies as you need today.

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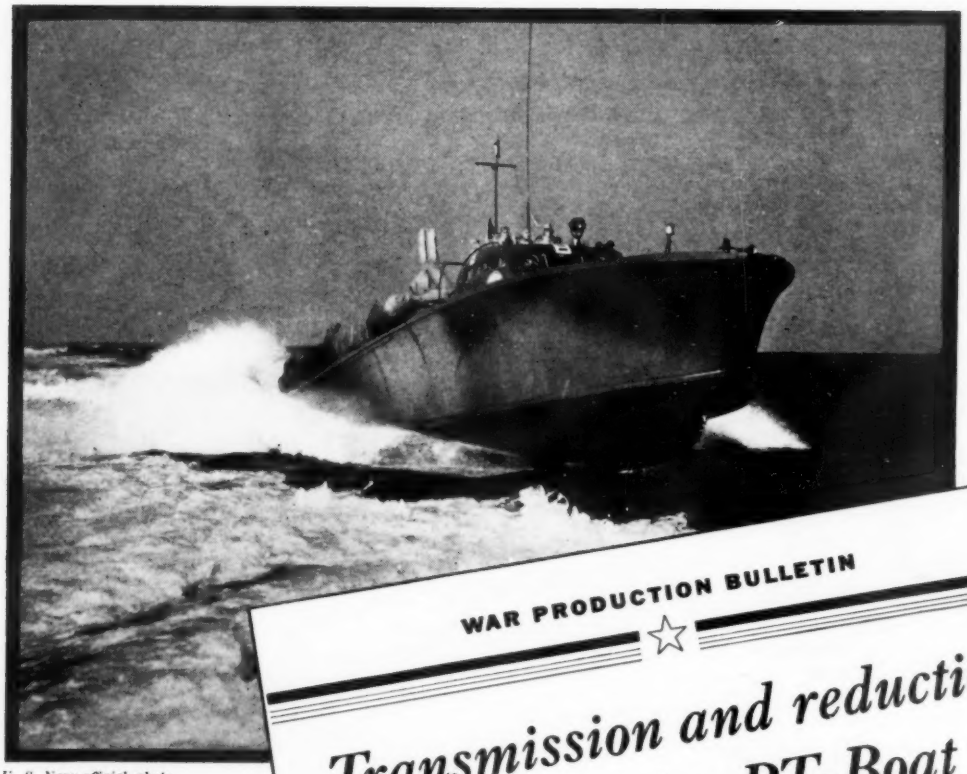

U. S. Navy official photo

WAR PRODUCTION BULLETIN

☆

Transmission and reduction drive gears for PT-Boat Power Plants are precision cut on 6-A and 7-A Type Fellows Gear Shapers, and teeth are finished on Fellows Gear Finishing Machines — to fit them for the responsible service demanded.

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Gear Accuracy

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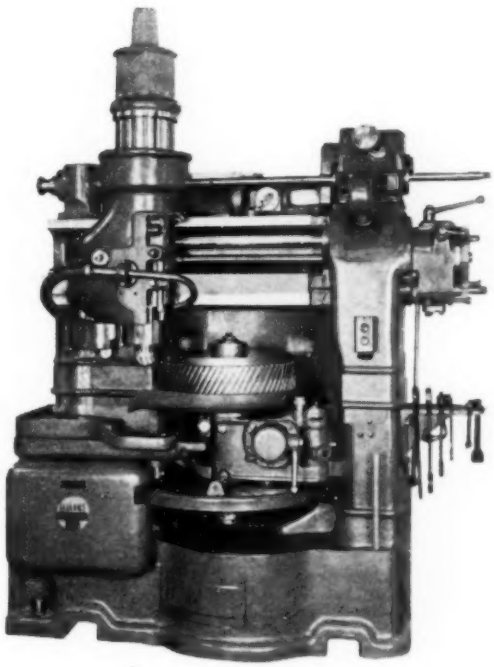
Many gear makers are developing gear making methods which will stand them in good stead when the present conflict is over. Fellows products are doing their part to make these outstanding performances possible. For complete literature, write The Fellows Gear Shaper Company, Springfield, Vermont — or 616 Fisher Building, Detroit, or 640 West Town Office Building, Chicago.

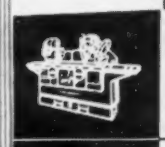
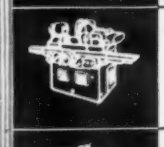
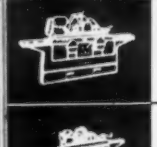
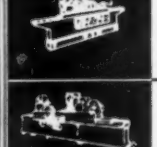
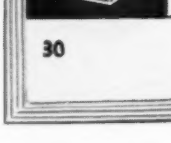


Method

. . . . FROM BLANK TO FINISHED GEAR

A QUICK INDEX TO

Cincinnati GRINDING MACHINES

	FOR PRECISION GRINDING . . .			
	HYDRAULIC UNIVERSAL 12-Inch 14-Inch 16-Inch 18-Inch (Model EB)	Center Type	For tool room grinding. For production jobs requiring the flexibility of a Universal Grinder. Between-center lengths up to 72 inches.	Pages 32 & 33
	PLAIN HYDRAULIC 6-Inch 10-Inch (Model EA)	Center Type	For short work manufactured in small lots or high production runs. Four sizes: 6 x 18, 6 x 30, 10 x 18, 10 x 36 inches.	Pages 34 & 35
	PLAIN HYDRAULIC 6-Inch (Model EB)	Center Type	For small to medium sized precision center-type work requiring either traverse or plunge cut grinding operations. Two sizes: 6 x 18 and 6 x 30 inches.	Pages 36 & 37
	PLAIN HYDRAULIC 10-Inch (Model EB)	Center Type	For average lots or high production center type work requiring exceptionally smooth finishes. Between-center lengths up to 72 inches.	Pages 38 & 39
	PLAIN 14-Inch 16-Inch (Model EM)	Center Type	For extremely accurate finish on important parts such as strip mill and tin plate rolls, machine tool spindles, gun mounts, etc. Seven between-center lengths: 36 to 168 inches.	Pages 40 & 41
	CENTERLESS No. 2 No. 3 (Model EA)	Centerless Type	For low cost grinding of large or small quantities of many parts having straight cylindrical, taper, or special shapes—and made of any material from plastic to hard steel. No. 3 size especially suitable for grinding bars.	Pages 42 to 45
	CENTERLESS No. 4 (Model EB)	Centerless Type	For high production, low cost grinding of cylindrical or formed parts, where heavy stock removal or the weight of the part are above average.	Page 46
	CENTERLESS LAPPING (Model EB)	Centerless Type	For producing high quality lapped finish at a rapid production basis.	Page 47

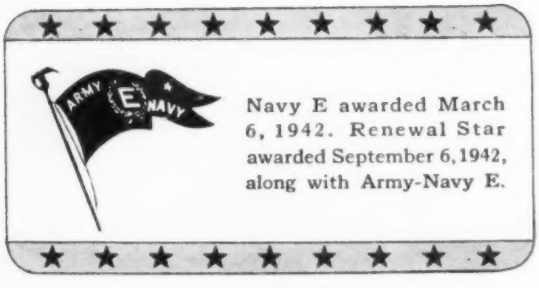
30

CINCINNATI

To make your precision cylindrical grinding problems easier to solve; to assure exceedingly close tolerances; to give you machines more independent of the skill of the operator — machines that easily meet your toolroom grinding and general manufacturing needs — the research, engineering and production departments of this company have developed CINCINNATI Grinding Machines to their present high degree of precision and efficiency. Catalog M-995-1 tells you about the wide range of

CINCINNATI

CENTER TYPE GRINDING MACHINES



Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

TOTHE RIGHT GRINDER!

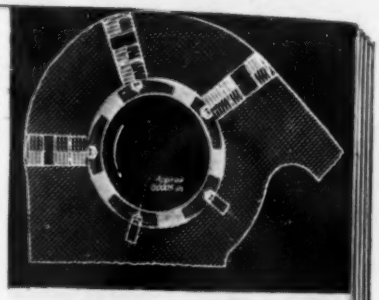
. with FILMATIC SPINDLE BEARING

CONTINUAL surface finish research by CINCINNATI has led to the development of an absolutely stable spindle bearing—the FILMATIC—now standard on all CINCINNATI Grinding Machines. This highly perfected structure fulfills *all* the basic requirements for a *precision* grinding machine spindle:

1. *An uninterrupted fluid film must be positively maintained between the spindle and bearing so as to prevent metallic contact and failure in service.*
2. *The axis of rotation when running idle must be maintained in a constant position—no fluttering or wavering can be tolerated.*
3. *Change in position of spindle axis with change in grinding forces must be as small as possible.*
4. *The bearing must be capable of supporting a load which varies in direction through a wide angle.*
5. *Frictional losses in the bearing should be substantially independent of applied load.*
6. *Bearing must be as fool-proof as possible, with minimum wear, and must not require adjustment for varying grinding conditions such as finishing and roughing.*

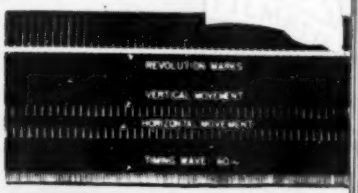
In the FILMATIC bearing, three or more separate, self-adjusting shoe members produce independent converging oil films which develop high radial pressures—and thereby force the spindle into a central position. It is virtually locked by "fluid vise jaws" which adjust their wedge angle to accommodate the load while still permitting perfect freedom of rotation. Frictional horsepower is practically independent of the applied load. In actual operation for several years on hundreds of CINCINNATI precision grinding machines, maintenance of FILMATIC bearings has been negligible.

Below: The clear reflection on this cylinder, ground on a CINCINNATI Grinder with FILMATIC spindle bearings, is evidence of the high finish secured with these bearings.



Basic principle of FILMATIC bearings: Rotation of spindle carries oil under shoes which adjust themselves to create wedge-shaped films. This action builds up very high radial pressures—and thereby forces spindle to rotate on dead center. Spindle flutter is thus eliminated.

Old style bearing—with 60 millionths vertical flutter and 25 millionths horizontal flutter. Tips of the wave peaks indicate the spindle position once each revolution. The irregularity in position of the wave tips in this oscillogram indicates a slight fluttering of the spindle axis.



FILMATIC bearing—no discernible spindle flutter. The even alignment of the wave tips in this oscillogram indicates a true running spindle.

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machines manufactured by CINCINNATI GRINDERS INCORPORATED. It contains illustrations and a brief description of each machine, specifications and feature highlights. It will prove a quick index to help you choose the right type of machine for your precision cylindrical grinding requirements. When you have looked over Catalog M-995-1 and have selected the machine you think best suited to your needs, ask for individual specification catalogs which will give you more complete information.

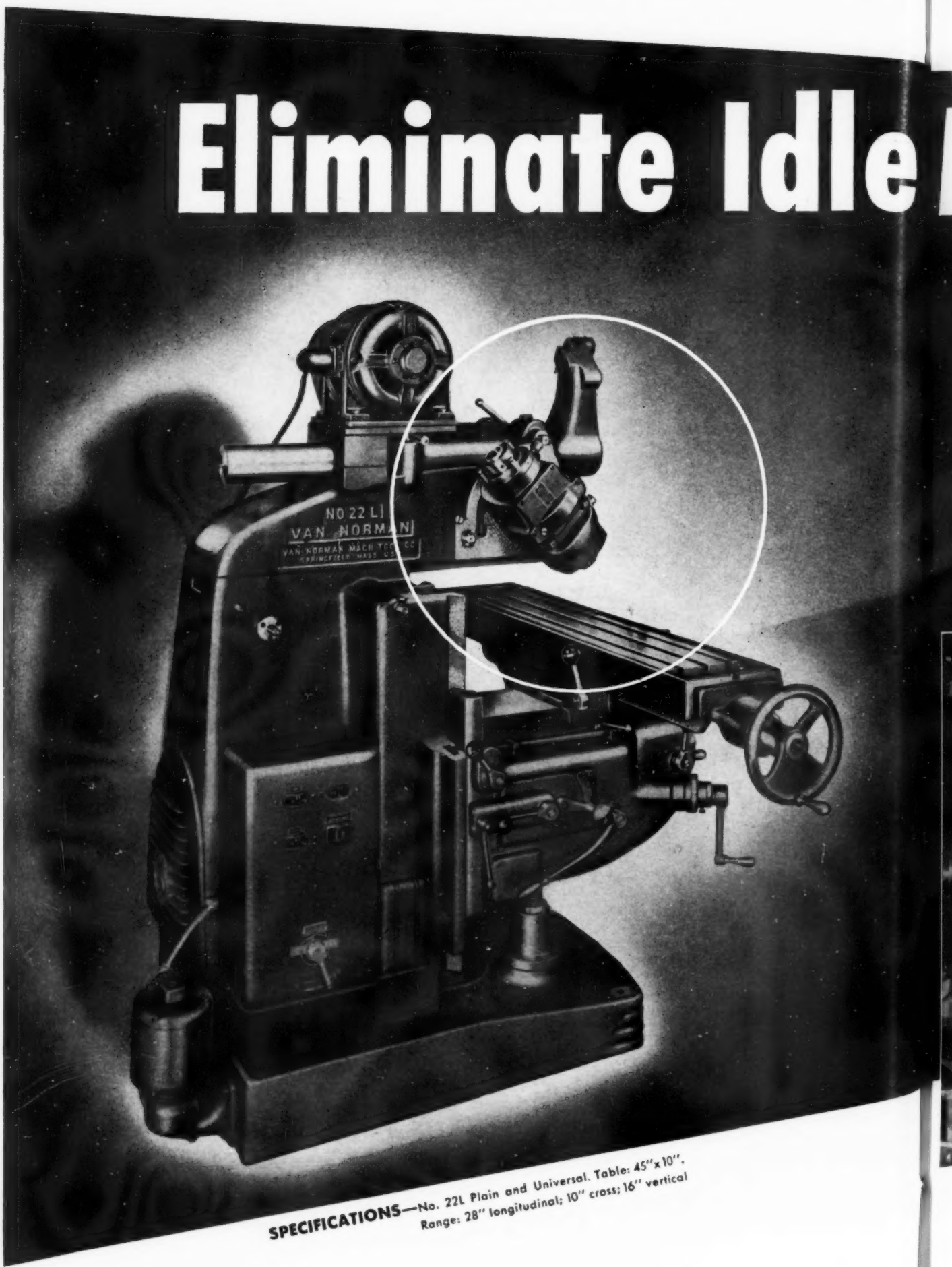
Catalog M-995-1 is an official communique from Grinding Headquarters, and will be sent free to those interested. Send for your copy of this book today.

GRINDERS INCORPORATED

CINCINNATI, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Eliminate Idle



SPECIFICATIONS—No. 22L Plain and Universal. Table: 45"x10". Range: 28" longitudinal; 10" cross; 16" vertical

e Machine Time

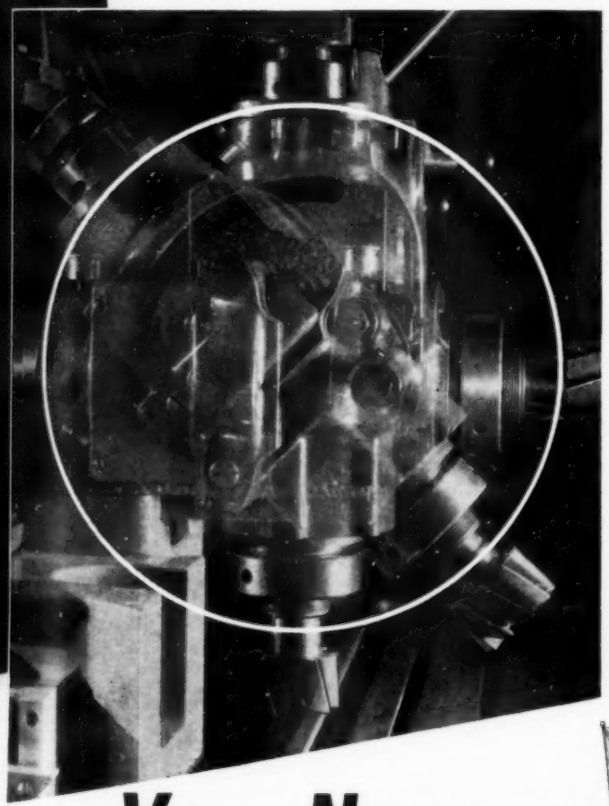
CAUSED BY WORK RESET-UPS

★ ★ ★ ★ ★

WITH VAN NORMAN RAM-TYPE UNIVERSAL MILLERS

Repeated set-ups of a work-piece through successive milling operations result in production loss because the machine is idle and non-productive while the operator makes the reset-up. Added up, this idle time often exceeds the machines productive time.

You can minimize idle machine time and increase production with a Van Norman Ram-type Universal Miller . . . the milling machine that gives you horizontal, angular, or vertical milling without changing the set-up or moving the work to another machine. Not only does this enable you to complete most jobs with the original set-up, but it also eliminates errors and subsequent work spoilage that very often results with continuous reset-ups.



Adjustable Cutterhead Mills at any Angle

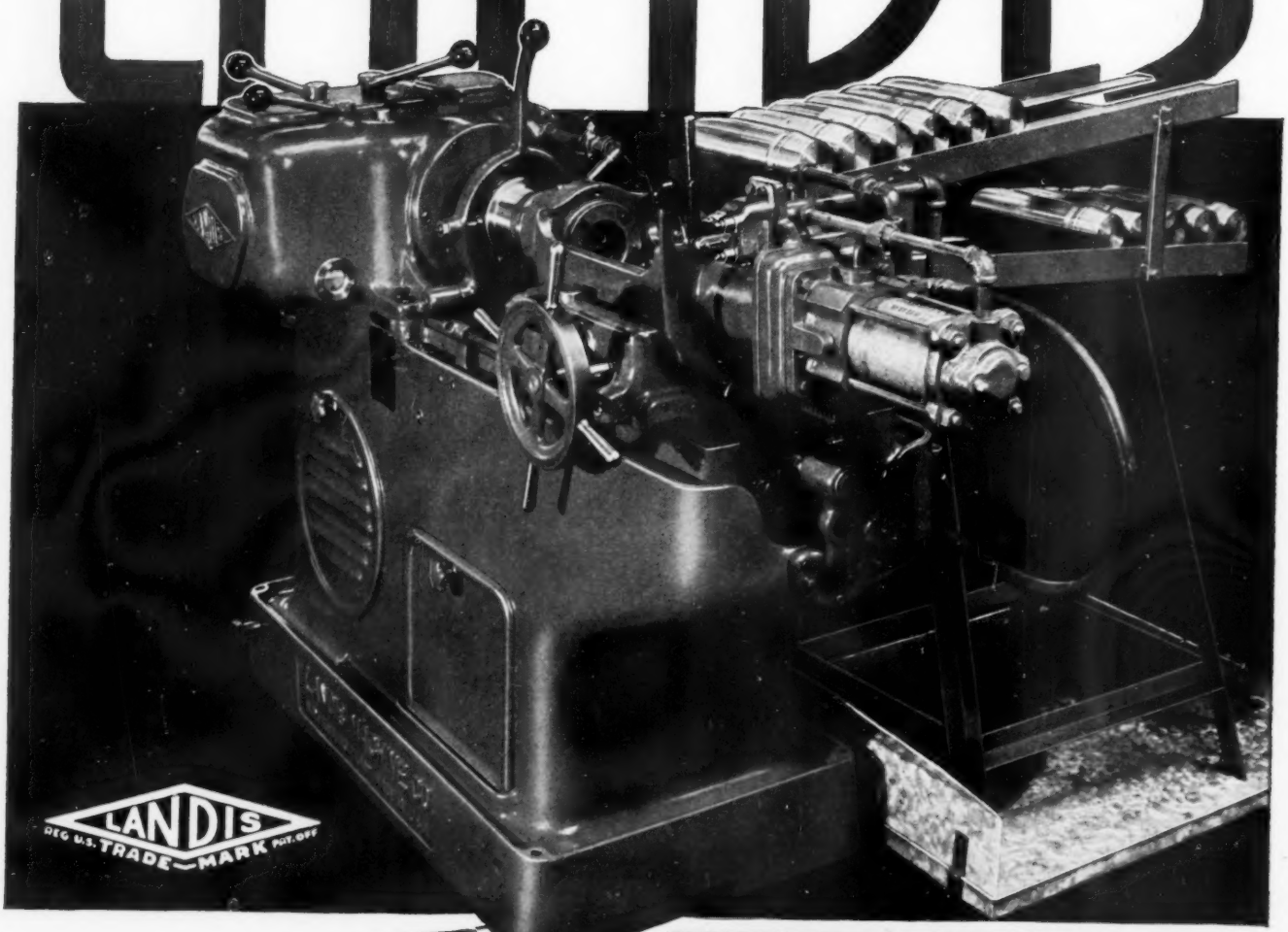
The Van Norman Swiveling cutterhead, mounted on a sliding ram, is quickly and easily moved to any desired cutting position between horizontal and vertical. Three heavy clamping bolts hold the cutterhead rigidly in position for precision milling. Hardened stops, accurately set at the factory, are provided for 0° and 90° positions of the head. Angular positions are indicated on an easily readable dial, graduated in degrees.

ARMY E NAVY

Van Norman Milling Machines

VAN NORMAN MACHINE TOOL CO., SPRINGFIELD, MASS.

LANDIS



The LANDIS LINE

THREAD CUTTING MACHINES
- Landmaco Threading Machines
- Bolt Factory Threaders
- Automatic Forming and Threading Machines
- 4 Spindle Semi-Automatic Threading Machines
- Pipe and Nipple Threading Machines

THREAD CUTTING DIE HEADS
- Landmatic (for Turret Lathes and Screw Machines)
- Landex (for Automatic Screw Machines)
- Lanco (for Automatic, Semi-Automatic and Hand-Operated Threading Machines)
- Lanco Pipe and Nipple Threading Heads
- Stationary Pipe Die Heads
- Reverse Taper Die Heads
- Standard Rotary Die Heads

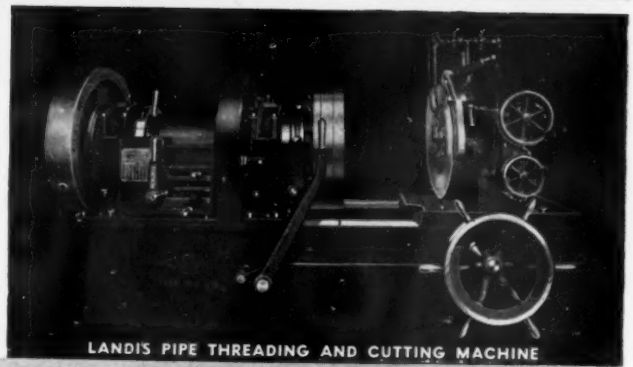
PRECISION THREAD GRINDERS

PIPE THREADING AND CUTTING MACHINES

ROLLER PIPE CUTTERS

CHASER GRINDERS

COLLAPSIBLE AND ADJUSTABLE TAPS



LANDIS PIPE THREADING AND CUTTING MACHINE

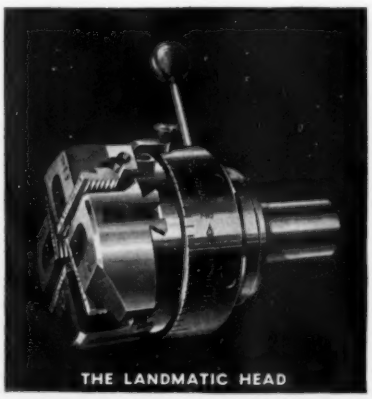
Write for the Booklet

"BE THREADWISE"

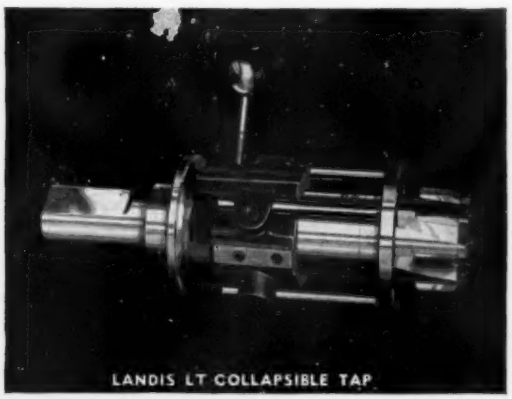
Production Line for 1943

THE LANDIS CHASER

In 1943, as in 1942, Landis Machines and Equipment will set the pace in Threading for War Production. During the past year, our Engineers have developed new threading equipment that has greatly increased threading production for many industries. Let us tell you about it.



THE LANDMATIC HEAD



LANDIS LT COLLAPSIBLE TAP

THE LANCO HEAD

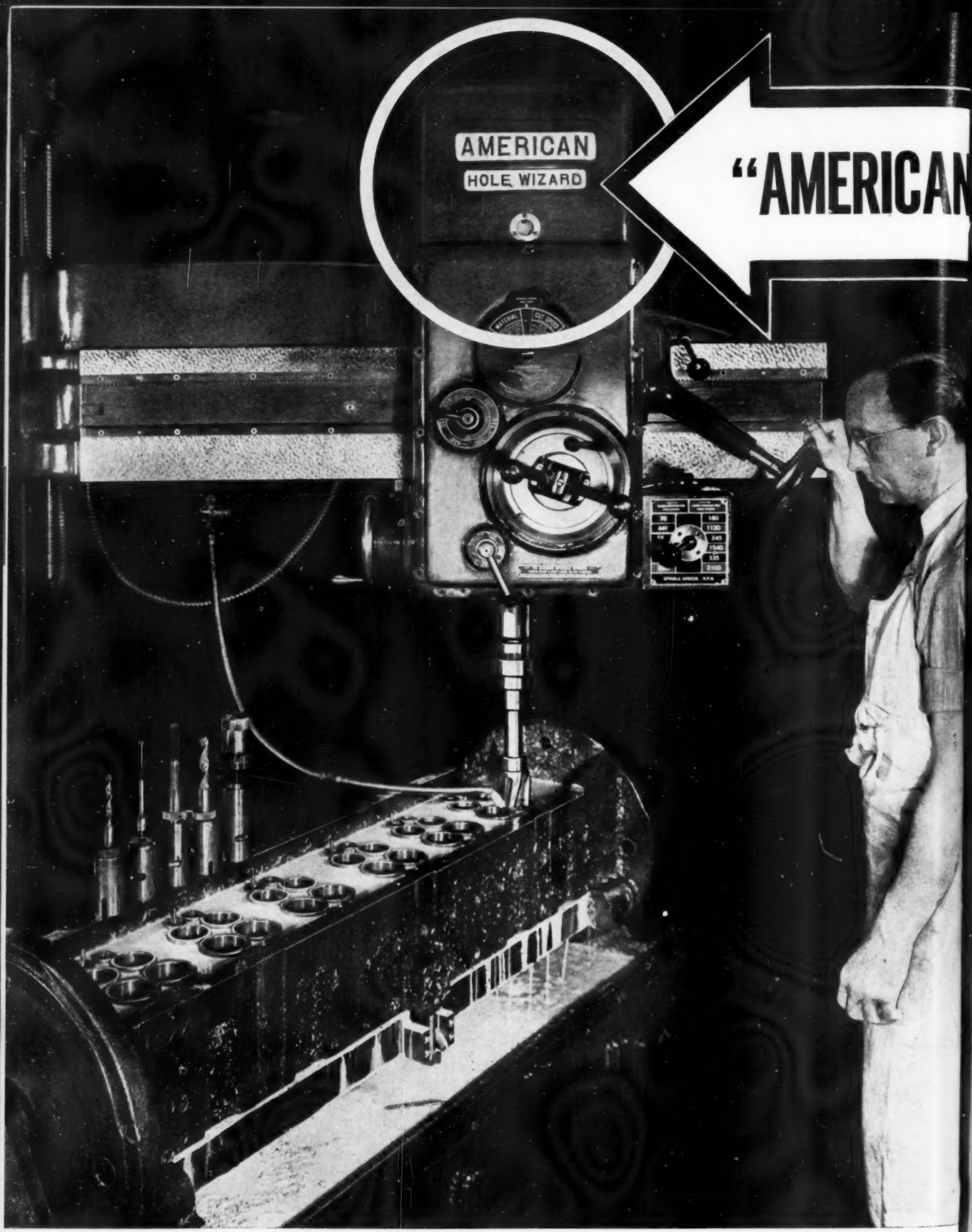
LANDMACO THREADING MACHINE

LANDIS ⅜" THREADING MACHINE

LITTLE LANDIS THREADING MACHINE

LANDIS MACHINE COMPANY

WAYNESBORO · PENNA · U·S·A·



THE AMERICAN TOOL WORKS CO.

CINCINNATI • OHIO • U. S. A.

LATHES RADIALS SHAPERS

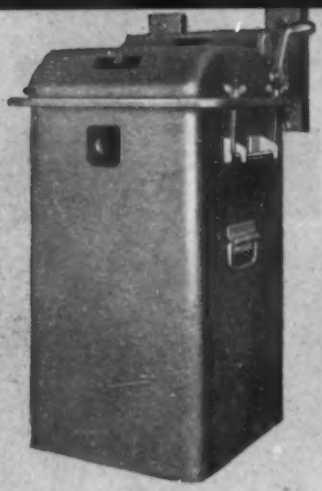
Don't

WASTE MAN-HOURS

ND CRITICAL MATERIAL

uilding Special Enclosures

...there's a STANDARD G-E combination starter to meet every operating condition



CORROSION-RESISTANT

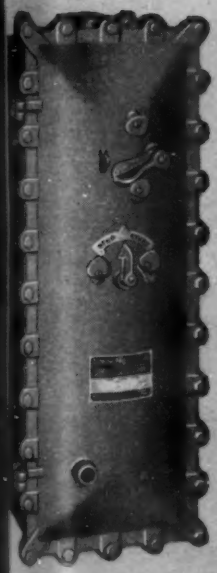
These starters (Type 8) are made in two forms—one for corrosive atmospheres and one for hazardous locations. All their arcing parts and terminals (for use in hazardous locations) are at least six inches under oil.

GENERAL-PURPOSE

The Type 1 enclosure is suitable for general-purpose, indoor applications where atmospheric conditions are normal.

DUST-TIGHT

The Type 5 enclosure is for use in steel mills, cement mills, and other locations where the dust content of the atmosphere is so heavy as to make a dust-tight case desirable. The cases are of heavy sheet metal, equipped with heavy gaskets, clamping bolts, and wing nuts.



FOR HAZARDOUS LOCATIONS

The Type 7 case for Class 1, Group D, locations is made of cast, high-strength alloy. These starters can withstand internal explosions. The flanges, which are securely bolted on all sides, are ground to tolerances that will not permit the escape of hot gases.

WATERTIGHT

The Type 4 case is suitable for outdoor use, and for installations in damp places indoors, such as in dairies and breweries.

The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment.

Order STANDARDS *to save time and material*

NEVER ENOUGH production time—scarce material urgently needed! Both far too valuable to be spent in building unnecessary control rooms and special enclosures.

But delivered-ready-to-install control isn't all that the General Electric line of standard combination starters offers you.

These starters combine two devices—a fused motor-circuit switch and a magnetic starter—in one compact unit. This saves you one complete mounting job. They come to you completely wired and ready to install—saving all the time and material needed to wire up two individually mounted controls.

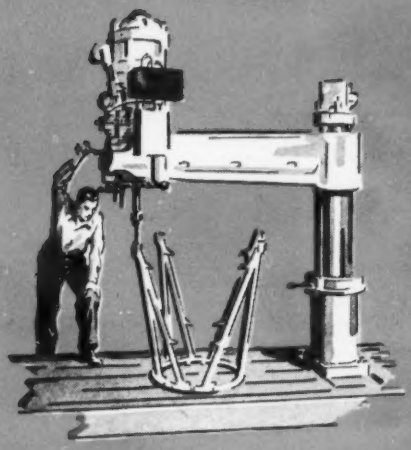
If you wish, our local sales engineers will help you select the proper starter for your job from this standard line of G-E combinations—for a-c motors up to 200 hp. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

676-83-8490

When machine tools can't be had

Black & Decker Tools

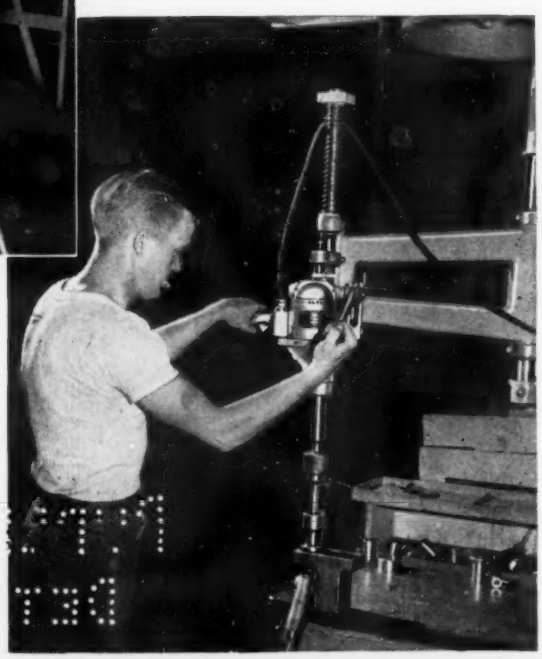


THEY COULDN'T GET THESE . . . SO HERE'S WHAT THEY DID!

AIRCRAFT MECHANICS, INC., needed equipment to start quantity production of welded steel structures for airplane engine mounts and landing gear . . . they couldn't get machine tools for months. But that didn't stop 'em! By combining ingenuity with Black & Decker Portable Electric Tools, they built their own special equipment—saved 3 to 4 months starting production. The pictures here tell the story.

The case of Aircraft Mechanics, Inc., is not unusual. We have just published a booklet showing how other ingenious war producers have combined brains with Black & Decker Tools—and built special equipment to do special jobs when

(Left)
WAR WON'T WAIT so, around a Black & Decker 7/8" Utility Drill, Aircraft Mechanics, Inc., built this special device for dressing the side edges of bearings. The device pulls up instead of bearing down. A special reamer is inserted on the end of a special chuck underneath.



(Right)
IN A RADIAL ARM of their own design, Aircraft Mechanics, Inc., uses another Black & Decker Drill to do the work of a 48" radial drill press, for drilling operations on aircraft engine mounts. Ingenious adaptations like this helped save 3 to 4 months starting production.

(Above)
IN "HOME MADE" JIG, on which a hand-turned thumbscrew exerts a pulling up action, a Black & Decker Utility Drill is used for dressing—or "spot facing"—the under sides of bearings. These Black & Decker Tools are standing up under rough usage, running continuously 24 hours a day.

do the Job!

achine tools were not available. It's called They Used Their Heads"—and a copy is yours the asking. Write to: The Black & Decker fg. Co., 716 Pennsylvania Ave., Towson, Md.

. . . and that's not all!

addition to coming through on these "special" bs, Black & Decker Tools also are speeding war oduction on countless "regular" jobs—such as drilling and tapping, screw driving and nut running, sanding and grinding, sawing and sheet metal cutting. They probably can step up your war production schedule, too.

Expert Help for You: If you have a tooling problem, phone your nearby B & D Distributor. He's ready to serve you quickly—with expert tool information—or as a dependable source of supply.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

PORTABLE ELECTRIC **TOOLS**

"IT'S TOUGH ON THE DRILLS--BUT THEY CAN TAKE IT!" . . .

ye Aircraft Mechanics, Inc. Here they have used a Black & ecker Utility Drill in building their own horizontal drill press. ccording to their report, this outfit is very fast and is doing the

called "They Used Their Heads"—illustrates more such ingenious adaptations of Black & Decker Tools. A copy is yours for the asking. Just write: The Black & Decker Mfg. Co., 716 Pennsyl-

ABLE TO TAKE IT--
ON THE BATTLE LINE

ABLE TO TAKE IT--

IN THE TOOL ROOM OR ON THE PRODUCTION LINE

Built to "dish it out" and take it, too, Uncle Sam's tanks demand tough materials and skilled design to give them stamina and striking power.

The same principles hold for milling machines—the machine tools that are mighty important in building tanks and other weapons. In tool room or on the production line, milling machines must be built to perform at a record-breaking pace and maintain close tolerance-accuracy in operation.

The center bearing on the spindle of Milwaukee Milling Machines reduces by one-half the distance between bearings — *increases rigidity eight times!*

Ask the man at the controls of a Milwaukee — he can tell you how important this center bearing is (in addition to the husky column) in providing built-in rigidity and all that it means in sustained accuracy — longer cutter life — smoother performance at all speeds and feeds.

KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WISCONSIN

Buy Victory with at least 10% in War Bonds!

Milwaukee MACHINE TOOLS

...r Victory

...nd For Your ...uture...

...UY WAR BONDS ...ND STAMPS!

...r Home...
...r Bonds and ...mps provide a ...d way to save ... the home you ...e always wanted ...wn.

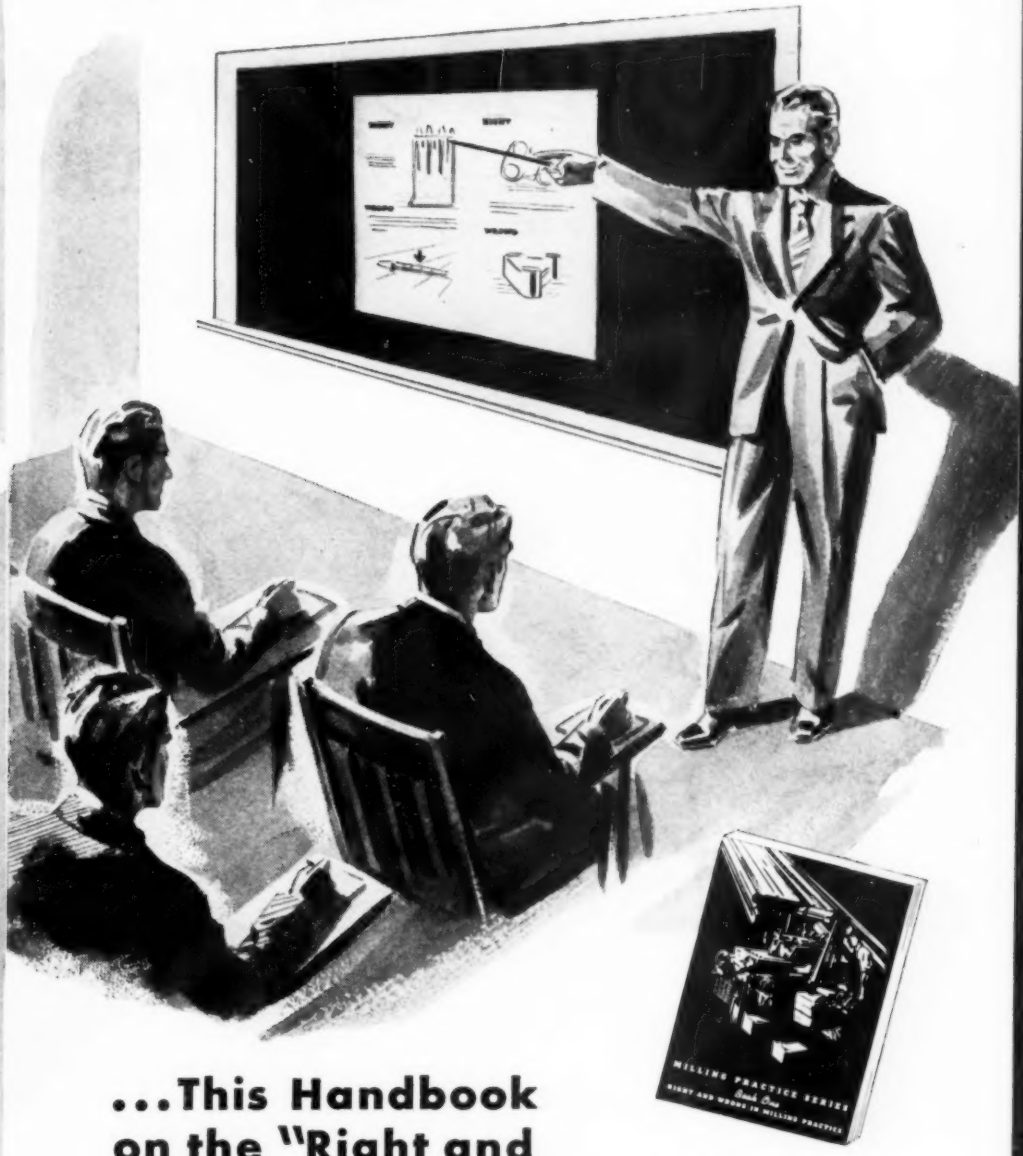
Your Children's Education...
War Bonds and Stamps — a good way to lay aside funds for educating your children.

...New Car For ...ur Family...
...ve now with War ...nds and Stamps ... that new car you ...ll want to buy ...en the war is over.

'43 FOR VICTORY

Buy VICTORY WITH AT LEAST 10% IN WAR BONDS

JUST LIKE A LECTURE ON THE FUNDAMENTALS OF MILLING...



...This Handbook on the "Right and Wrong of Milling Practice"

Even experienced milling machine operators find this handbook useful and valuable in brushing up on the fundamentals of sound milling practice.

Written in an easy-to-understand style — contains hundreds of illustrations depicting the right and wrong way of operating a milling machine — plus many valuable suggestions on short cuts in milling — and the correct care and attention of the machine.

Write for your personal copy of the newest Kearney & Trecker publication, "The Right and Wrong of Milling Practice".

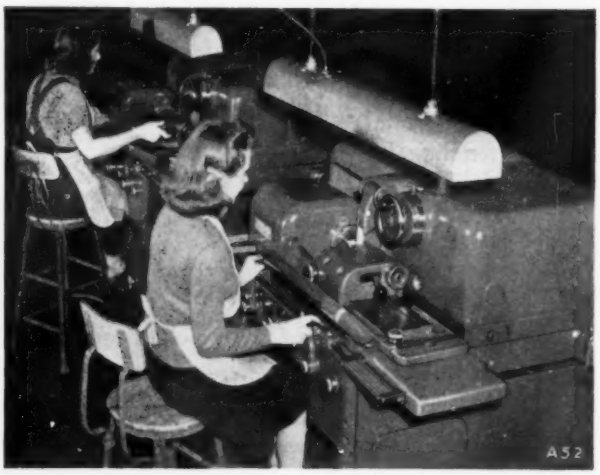
Kearney & Trecker *Products* CORPORATION
MILWAUKEE, WISCONSIN

Kearney & Trecker CORPORATION
Milwaukee, Wisconsin

To Finish The Job Quicker . . .

SOLVE LABOR S

PLACING THESE T



SHORTAGE PROBLEMS BY TOGETHER LIKE THIS

Is your production suffering because of a labor shortage? In many plants this problem simply must be overcome in order that the upward swing in production can be continued.

Like other problems facing American industry this one will be licked. Here is one way to do it --

Enlist the aid of the thousands of American women who are eager to serve their country as production soldiers. Put them to work in your plant—together they will form a battalion that will release great numbers of skilled male workers for other more strenuous jobs. As for their ability to operate machines, well, here is the actual experience of a well-known manufacturer of chucks.

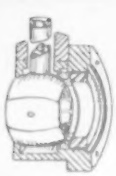
He is grinding chuck jaws on Landis 4" Type H Plain Hydraulic Grinders operated by comparatively inexperienced female employees. He reports as follows: "Since the installation of these Landis machines, production has increased 35%, a power saving of 30% has been effected and wheel life has been greatly extended. Maintenance records have been very low."

Perhaps, if you have a labor shortage problem, it can be solved in a similar manner. But remember—for best results choose grinding machines that are easy to set up and operate, and that can be used continuously without the need for time-consuming readjustment and repair. Or, more specifically, for best results choose Landis Grinders.

Unusual Performance As Usual

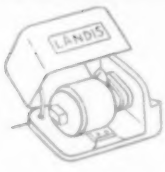
PRECISION LANDIS GRINDERS

LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA.



MICROSPHERE WHEEL SPINDLE BEARINGS

CYCLE CONTROL LEVER



VARIABLE VOLTAGE HEADSTOCK

395

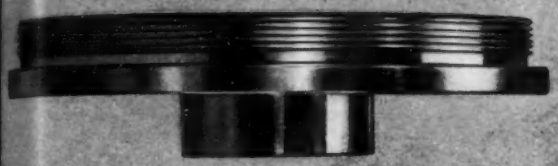
If you have a job like this—t

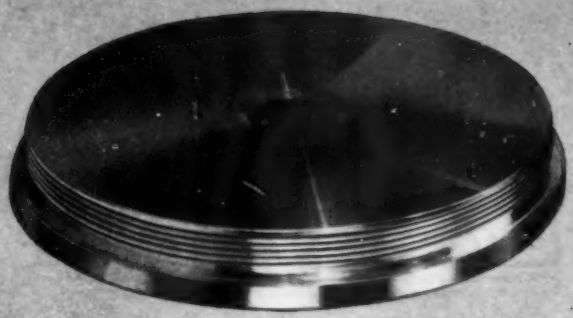
★

★

★

s-turn it on a Monarch!





Bombardiers don't care how bombs are made, just so we keep their racks full, ready to drop on the enemy.

That's why this manufacturer of base plugs put to work the Monarch lathes he already had, rather than wait for new machines that might be better fitted to the job.

First, the hub of the plug is turned on an older Monarch. Then, chucking on this hub with a 3-jaw chuck, and using the square turret with multiple positive carriage stops and clips on the cross-feed dial, our customer performs the following operations in one setup, on Monarch 18″ Model BB lathes, as illustrated:

1. Face
2. Countersink hole
3. Turn O. D.
4. Turn shoulder
5. Neck
6. Chamfer back edge
7. Rough thread
8. Finish thread
9. Chamfer thread

Actual machining time—5 Min., 25 Sec.

The material is 1035 heat-treated steel, with a tensile strength of 70,000 pounds. A tungsten-carbide tool chases threads to finished accuracy. Production is on schedule—thus good old Yankee ingenuity keeps turning out Victory implements, faster for fighters.

If you have a War production job you think might be done on a lathe, and don't quite know how to set it up, our field engineers will gladly help you.

THE MONARCH MACHINE TOOL COMPANY
SIDNEY, OHIO

MONARCH LATHES

COVER THE TURNING FIELD

He Never Has to Take His Eyes Off the Cutter and Work

DEVLIEG JIGMIL

Spindle start, stop and reverse—

Power vertical feed and rapid traverse movement—

Power horizontal feed and rapid traverse movement—

Power automatic table retraction and repositioning—

Power feed and rapid traverse to bar movement—

are all carried in a master switch on the spindle head—at the operator's finger tips.

Thus, the operator of the DeVlieg Jigmil can fix his vision on the cutter and work—never has to look at controls during operation.

The Jigmil is what a machine tool should be—a powerful and accurate extension of the operator's hand. The value in precision boring and milling is apparent.

It's a NEW *Type Machine*

Spacing Accuracy of a Jig Borer . . . Performance Qualities of a Milling Machine . . . Convenience and Flexibility of a Horizontal Boring Mill.

New speed of operation . . . New standards of excellence of bored holes . . . New accuracy in milling . . . Automatic table retraction and repositioning dependable within .0002".

Many machines show 75% greater average daily productivity.

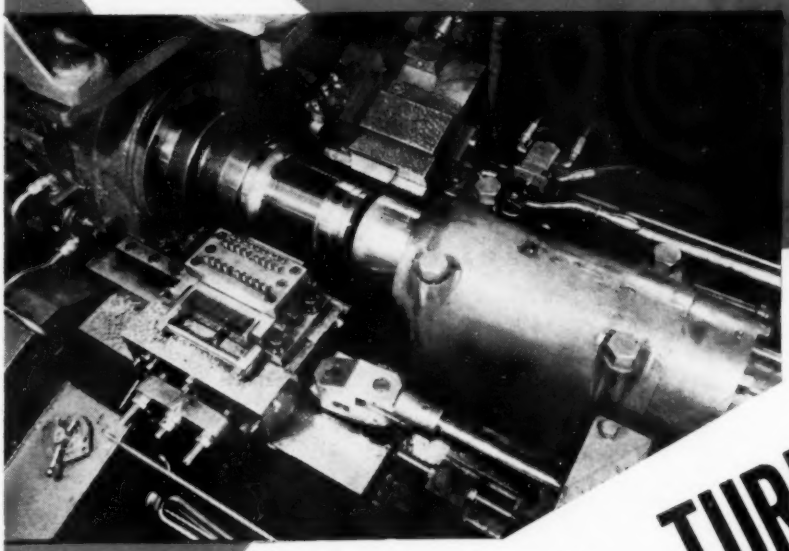
Write for Circular

DEVLIEG MACHINE TOOLS

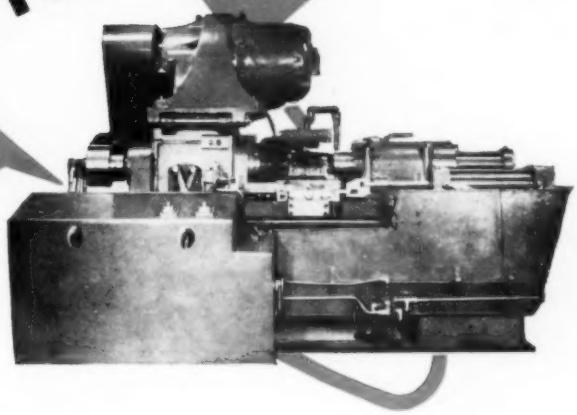
DE VLIEG MACHINE COMPANY

450 FAIR AVENUE, FERNDALE (DETROIT), MICHIGAN

Handling HEAVY DUTY AIRPLANE CYLINDER FINNING OPERATIONS . . . *with speed and accuracy*



ON THE SPARKS SEMI-AUTOMATIC TURNING LATHE



Actual performance on this class of work discloses big time savings in production through the tooling possibilities available on the SPARKS HYDRA-FEED LATHE.

For this job the front cross slide is arranged to carry 47 tools for turning the fins while the back slide carries one tool for cutting the radius on the large flange. Movement of tools is controlled automatically with power supplied hydraulically.

Work is held by an expanding arbor with dog tooth driving ring on work piece. A live center plug mounted in a retractable quill actuated by hydraulic cylinder constitutes the tail stock.

All feeds are automatically controlled through metering valves convenient to operator. Rapid gripping and release of work are provided through treadle-operated holding equipment.

A ball and roller bearing headstock providing four selective speeds makes it possible to handle a wide range of cylinder sizes on this machine. Ability to operate at slow speeds in order to handle exceptionally hard material is assured by the use of a reducing gear motor.

Get full details immediately

SPARKS HYDRA-FEED LATHE

SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.

RHYTHM CAN BE DESTRUCTIVE

THE rhythm of marching feet can set in motion forces that will make a great bridge tremble and sway.

These forces of rhythmic vibration are at their destructive worst when found in high-speed rotating parts. They attack entire assemblies, causing excessive wear, bearing overloads, loosening of parts, and early failure.

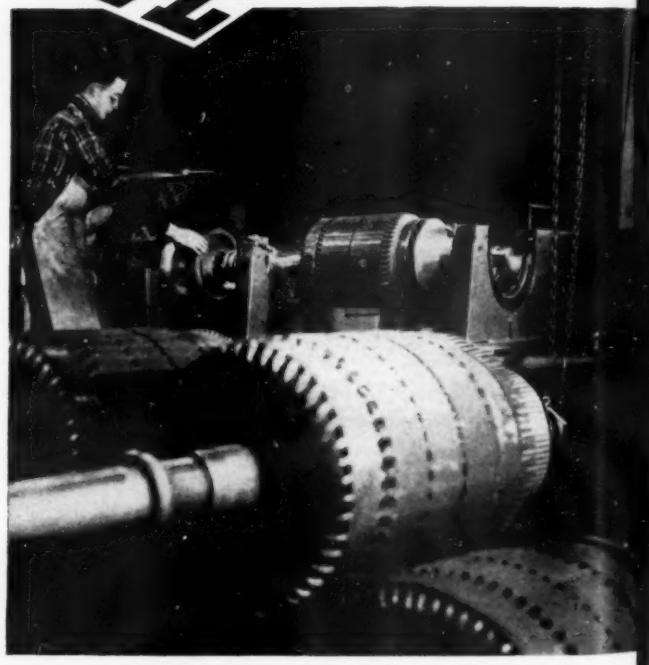
Today, Dynetric Balancing Machines work wonders in assuring quiet, efficient operation, and longer life. They determine static and dynamic balance more quickly, more economically, and more accurately than ever before.

GISHOLT MACHINE COMPANY

1201 East Washington Avenue • Madison, Wisconsin

Look Ahead—Keep Ahead—
With Gisholt Improvements

GISHOLT



DYNETRIC BALANCING MACHINES

locate and measure unbalance in a few seconds. By means of electron tube amplification, accurate readings down to .000025" are possible. Write for literature.

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

AUTOMATIC CHUCKING EQUIPMENT IS ANSWERING THE CALL *for "more"*

Photo by U. S. Army Signal Corps

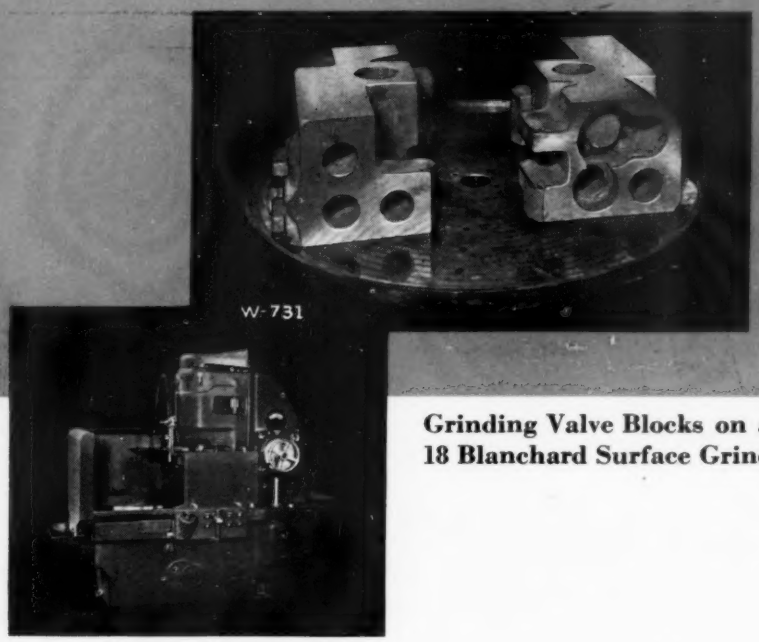
IT is quite natural that an organization which pioneered the development of equipment for producing accurate duplicate parts in quantity should be ready in a national emergency to contribute much to an expanded production program.

Potter & Johnston Automatic Chucking Machines are turning out accurate, difficult work, quickly and efficiently. Time per piece is being reduced and pieces per machine increased as P&J engineers apply their long experience and take full advantage of the unusual tooling facilities offered in P&J machines. Thus P&J is helping to answer the call for more airplanes, airplane engines, tanks, guns and a host of other essential war equipment.

THE POTTER & JOHNSTON MACHINE COMPANY, PAWTUCKET, R. I.

"PUT IT ON THE BLANCHARD"

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING



Grinding Valve Blocks on a No. 18 Blanchard Surface Grinder

Production

★ **Adaptability**

Fixture Saving

★ **Operation Saving**

Material Saving

Fine Finish

★ **Flatness**

Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

These cast iron valve blocks are finish ground from rough castings on the Blanchard surface grinder.

3/16″ of stock is removed from two sides of these valve blocks to limits of ±.005″. 4 pieces (8 surfaces) are produced per hour.

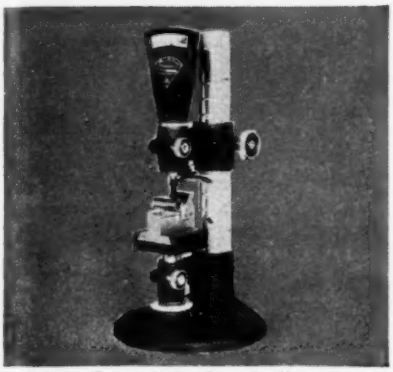
The close tolerances required between centers of bored holes and sides of block are easier to maintain because of the flat and parallel surfaces produced by Blanchard Grinding. Subsequent operations are always more accurate and made easier when the first operation is performed on a Blanchard.

BLANCHARD

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

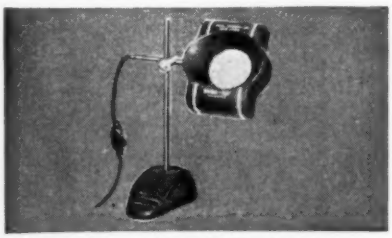
The BLANCHARD MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS., U. S. A.

OTHER INSTRUMENTS IN THE SCHERR LIMITED BUDGET INSPECTION LABORATORY

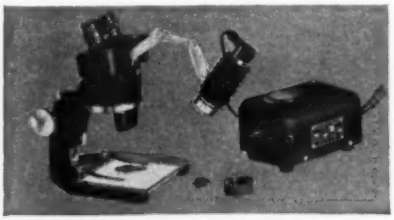


Scherr Comparitol — for checking gage blocks, gages and work for size, accuracy and wear.

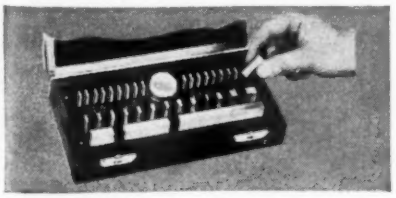
Atlantic Adjustable Limit Snap Gages —for accurate check-up, without having to depend on operator's skill. Sizes to 6".



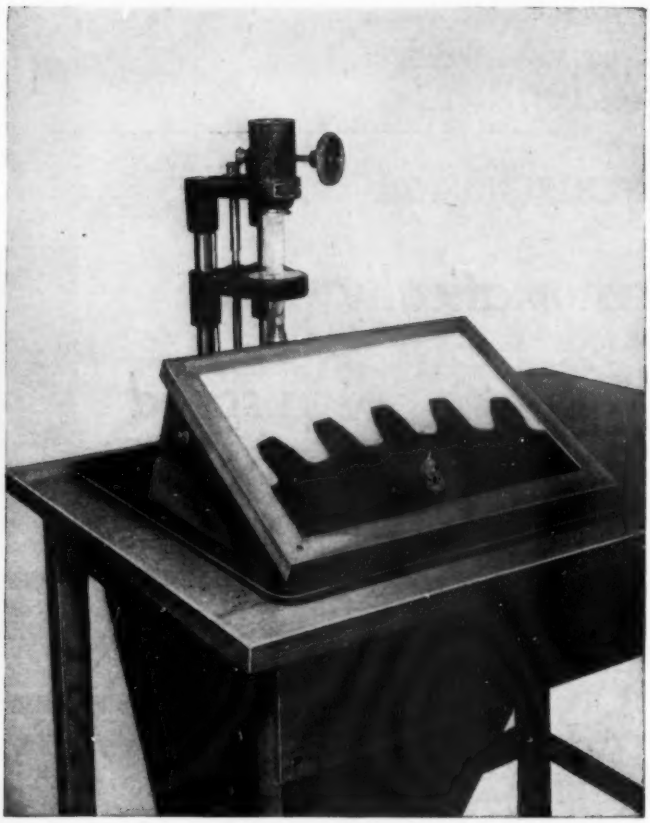
Magni-Ray—a wide field illuminated magnifier for close inspection of work and operations.



Spencer Binoculars—for detecting surface finish, imperfections, etc., by means of 3-dimensional vision.



Ultra-Chex—a 34 block set accurate to .000008" and providing a basic standard of measurements.



Eliminate guesswork

INSURE ACCURATE INSPECTING and CHECKING WITH THE WILDER PROJECTOR

This instrument—at a price within the reach of any shop—is an optical device for measuring or comparing objects by means of a magnified image both in transmitted or reflected light. It provides a simple, accurate method of

. . . checking tools and gages to eliminate errors at their source.

. . . inspecting and measuring tool work, pivoted work and small screw machine parts of all kinds.

. . . verifying tool settings by checking first parts produced.

. . . controlling tool wear through periodic inspection of work.

. . . inspecting finished product.

One of the most useful applications of the Wilder Projector is that of checking threads. By means of this instrument it is possible to detect inaccuracies which cannot be seen with the naked eye nor felt by go and no-go thread plug and ring gages. Low initial cost will be repaid over and over again in savings from the prevention of spoiled work, which results from the use of this instrument.

Easy to operate, simple and sturdy in construction, the Wilder Projector offers many opportunities to speed up measuring, checking and inspecting.

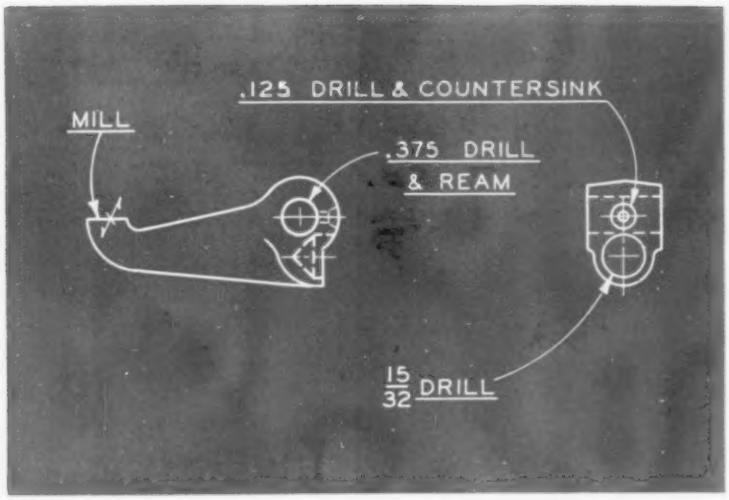
CONDENSED SPECIFICATIONS

Standard Magnifications—10x to 100x
Space occupied in bench—21"x24"
Height over bench—18½"
Depth below bench—20"
Size of screen—10"x16"
Size of cross slide stage—6"x5"
Capacity between centers—5"
Maximum swing of centers—2½"

Write, wire or telephone (Canal 6-1464) for further details, quotations and delivery dates.

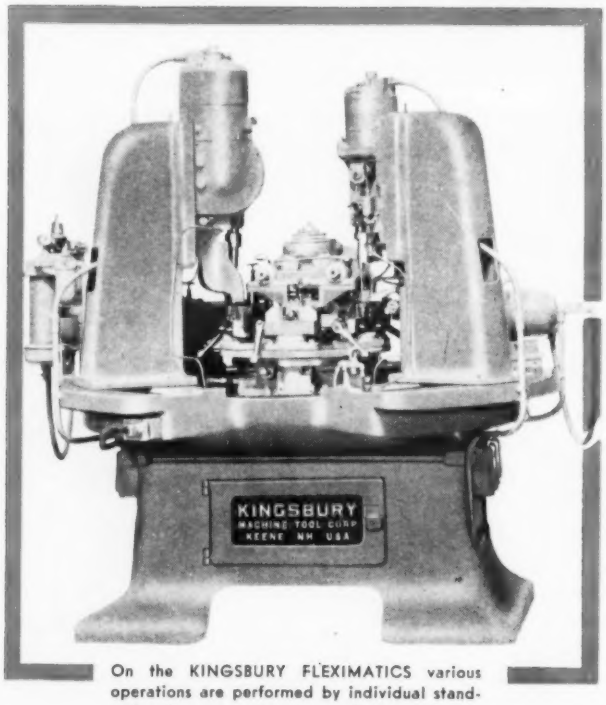
GEORGE SCHERR COMPANY, INC. 124 LAFAYETTE ST., NEW YORK, N.Y.

Automatic transmission parts automatically produced at top speed



FLEXIMATIC

by KINGSBURY



On the KINGSBURY FLEXIMATICS various operations are performed by individual standard units mounted on several types of sub-bases. Only a single chucking of the work is required regardless of the number of different operations involved. By this method of arranging standard automatic units, a unique combination of machining operations can be provided for as well as a flexibility in the machine for whatever change-overs may be necessary with a change in the nature of the work to be handled.

Drilling, reaming and milling forged steel levers for automatic transmissions are handled by this Model GD FLEXIMATIC in a single chucking of the work. Fixtures employed are hand operated, self-centering, two-jaw chucks.

The same principle of handling multiple operations which makes the FLEXIMATIC so highly productive on this job can be applied to other classes of work. That is why FLEXIMATICS are playing such a big part in today's all-out war program—turning out precision parts on a high production basis—performing drilling, reaming, tapping, counterboring, spot facing and other operations on intricate work and meeting the most rigid specifications.

All operations on FLEXIMATICS occur simultaneously. The time for one piece is the time for the longest single operation only—an advantage which not only means outstanding time savings but also savings in man-hours per piece. With FLEXIMATICS man power at machines is vastly more productive.

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U S A

RIVETT

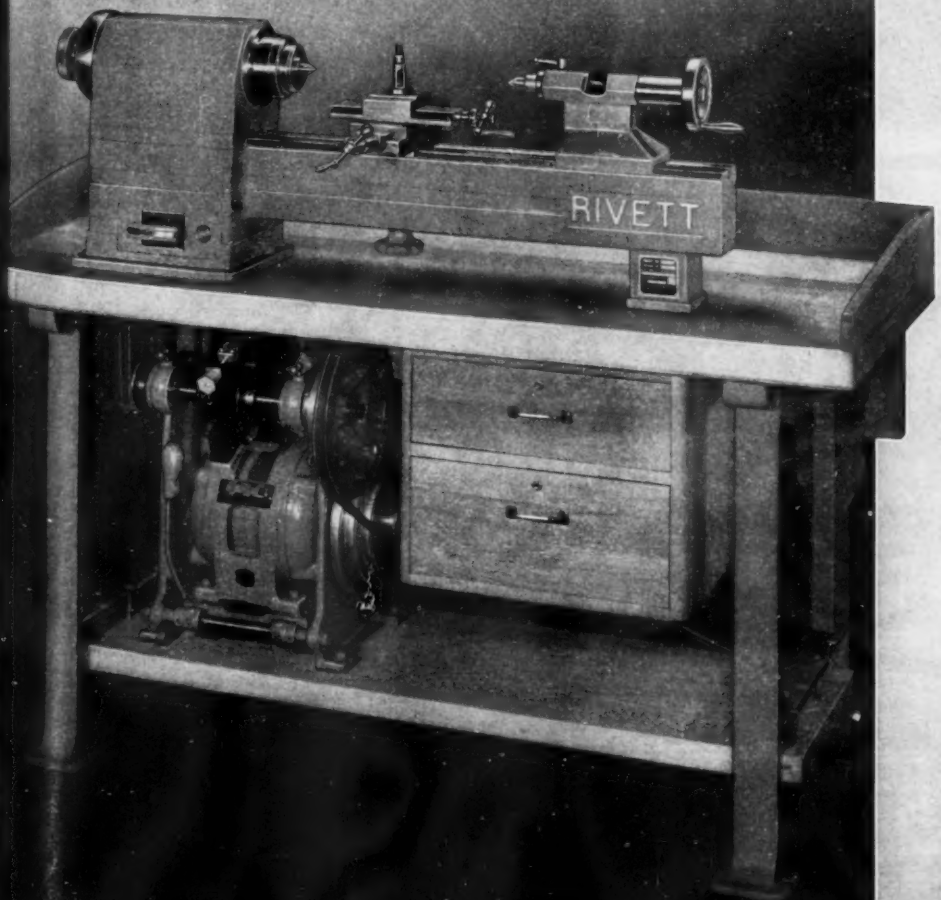
918 PLAIN BENCH LATHE

Revolutionizes Concept of Bench Lathe by Its Power and Vibrationless Performance

The Rivett No. 918 has been developed to advance the productive capacity of the plain precision bench lathe. Not only is it indispensable in the tool room and in light manufacturing, but it is capable of thousands of jobs often produced on heavy, costly machines. It has exceptional power, wide speed range, vibrationless performance, it is quickly set up, fast, accurate and trouble proof.

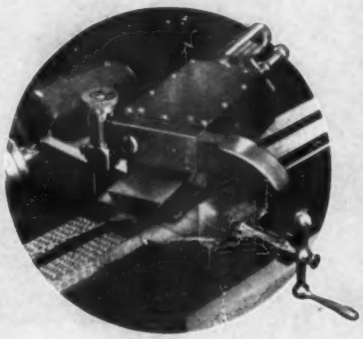
Operating convenience and long-life precision are well blended in the No. 918 design. Ball bearing spindle is mounted in rugged headstock enclosure supported by heavy box sectioned bed. Long taper key-drive spindle nose assures true running and positive drive for chucking attachments. Shoe mounting automatically squares compound slide rest with line of centers. Convenient control switch operates spindle drive. All driving vee belts are adjustable and may quickly be replaced without disturbing the lathe or drive assembly or removing the spindle from its bearings.

The No. 918 is furnished with bench or steel cabinet mounting and has a wide selection of attachments.



Slotting Attachment

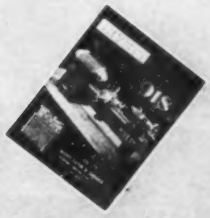
Universal Grinding Attachment



Automatic Slide Rest

SPECIFICATIONS

Swing over bed, dia.	9"
Distance between centers	18"
Collet capacity, max. dia.	1"
Step chuck capacity, max. dia.	6"
Jaw chuck capacity, max. dia.	6"
Spindle capacity, max. dia.	1⅛"
Slide rest, travel of tool post slide	5¼"
Slide rest, travel of cross slide	5¼"
Tailstock spindle travel	3½"
Spindle speeds, eight forward and reverse	
Low range	150-2500 r.p.m.
High range	225-3750 r.p.m.
Weight of lathe, mounting and drive, net	850 lbs.



For Further Description Write for Bulletin 918

918 PLAIN BENCH LATHE

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.

Let Norton Abrasive Engineers Help You on Your Grinding Jobs

20-Q2T-H is the recommended Norton specification for the straight wheel used to remove the bead from this large welded pipe. It combines the features of hard, tough Alundum abrasive and the special resinoid bond developed by the Norton research laboratories to give a fast cutting action and a good finish.

16-P4T is the suggestion for this Norton cup wheel used to smooth up the flame-cut radius on these steel bars. Again the abrasive is fused alumina (Alundum) but the resinoid bond is of a slightly different formula to meet the different conditions; the grit size is slightly coarser and the grade softer because of the larger contact area of the cupwheel.

36-P5BE (No. 12 treated) is specified for the small wheel for this frame of aluminum—a material that is not easy to weld or grind. Here the fast cutting features of Alundum abrasive are combined with the cool cutting action of the patented Norton B-E vitrified bond—plus a special filler treatment to prevent wheel loading.

Your grinding jobs may not be similar to any of these but Norton abrasive engineers will be glad to study them and recommend wheels that will meet your conditions—that will speed production on your war jobs.

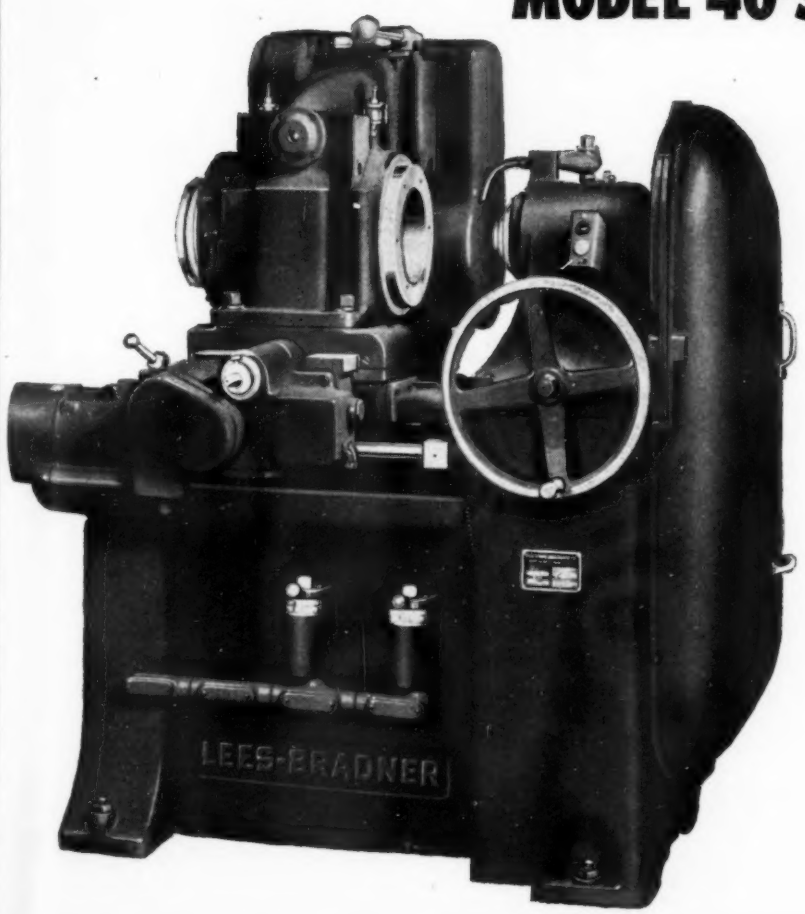
NORTON COMPANY
Worcester, Mass.

W-884

NORTON ABRASIVES

Lees-Bradner

MODEL 40'S MILLING THE THREADS OF VICTORY

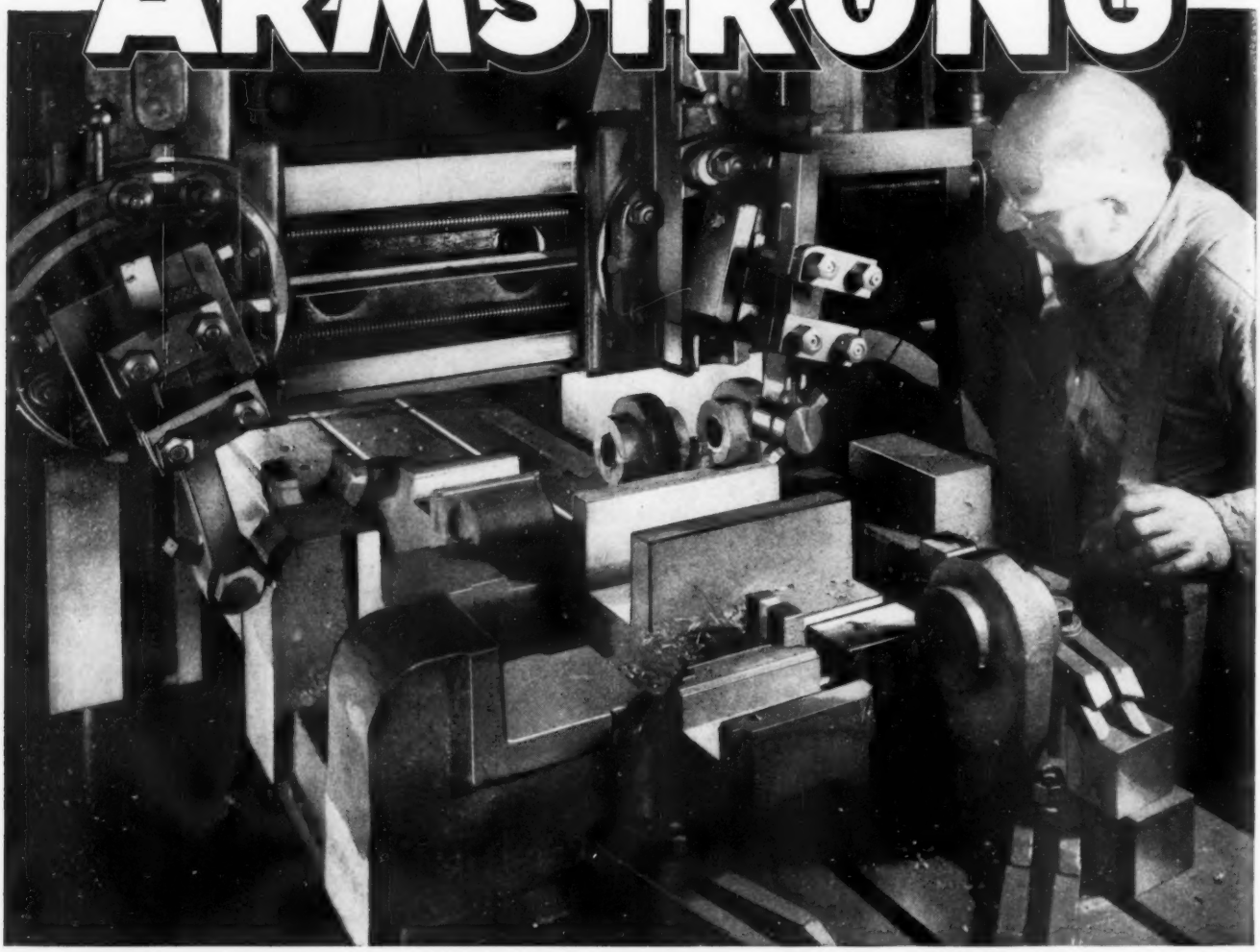


Just one of the numerous plants where the Lees-Bradner Model 40 Automatic Chucking Thread Millers are producing accurate threads on a mass production basis on urgently needed war materials.

A rugged, compact unit, of high production so simple to operate it does not require skilled labor. Use it on your threading work requiring extreme accuracy in quantity. A letter will bring full details.

The LEES-BRADNER Company

ARMSTRONG



Use ARMSTRONG TOOL HOLDERS on Production Machines too

ARMSTRONG TOOL HOLDERS, usually thought of as tool room tools, because they are standard on lathes, planers, slotters and shapers in tool rooms everywhere, are proving to be the answer to many tooling problems on strictly production machines.

To the production department they bring the same advantages which have put them in over 96% of the machine shops and tool rooms.

- They have the strength to stand up to any speeds and feeds — to production speeds and feeds far in excess of those common in the tool room.
- They take cutters any operator can quickly grind from stock shapes of high speed steel.
- They reduce tooling-up to the selection of a cutter and adjusting it for clearance.
- They "Save: All Forging, 70% Grinding and 90% High Speed Steel."

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

315 N. Francisco Ave. Chicago, U.S.A.

Eastern Warehouse & Sales: 199 Lafayette St., New York

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

YOU COULD FIND THEM IN A BLACKOUT

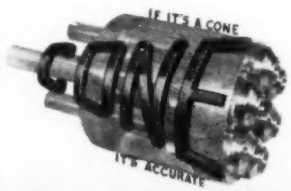
CONE CAMS ARE SO ACCESSIBLE

There is no question about the accessibility of Cone Cams. They are all on cam drums on *one* Camshaft, which runs the full length of the machine — in the rugged top bed, above the work area, free from falling chips and protected from dirt and foreign material.

As this feature places Cone Cams always within easy reach of the operator, it facilitates quick changeover. The clear visual picture of the cams in actual operation assists the new operator to more quickly know his machine.

The Cone Over-Head Camshaft is but one of the advantages identifying Cone Departmental Design, and, from the time of its inception, has marked a step forward in multiple spindle automatic construction.

If your production-pulse needs priming it will pay you to specify Cones.



CONE AUTOMATIC MACHINE CO., INC.
Windsor, Vermont, U. S. A.

IF THERE is one thing in which the Faith of all Americans is fully justified it is in the ability of American Industry to produce. From the very beginning of the War Emergency we have all expected production on a truly American basis and this is in itself something to ponder. But the actual performance of American Industry with its dander up and its Patriotism aroused exceeds the wildest dreams of our greatest optimists and puts to shame the few who knew it couldn't be done and why.

We are proud of the engines and guns and machines our men have contributed to this miracle. We are proud to have taken an active part in an undertaking so inspiring. And when the war is over and won we shall be proud to participate in the inevitable sequel to the Production Miracle of 1942.

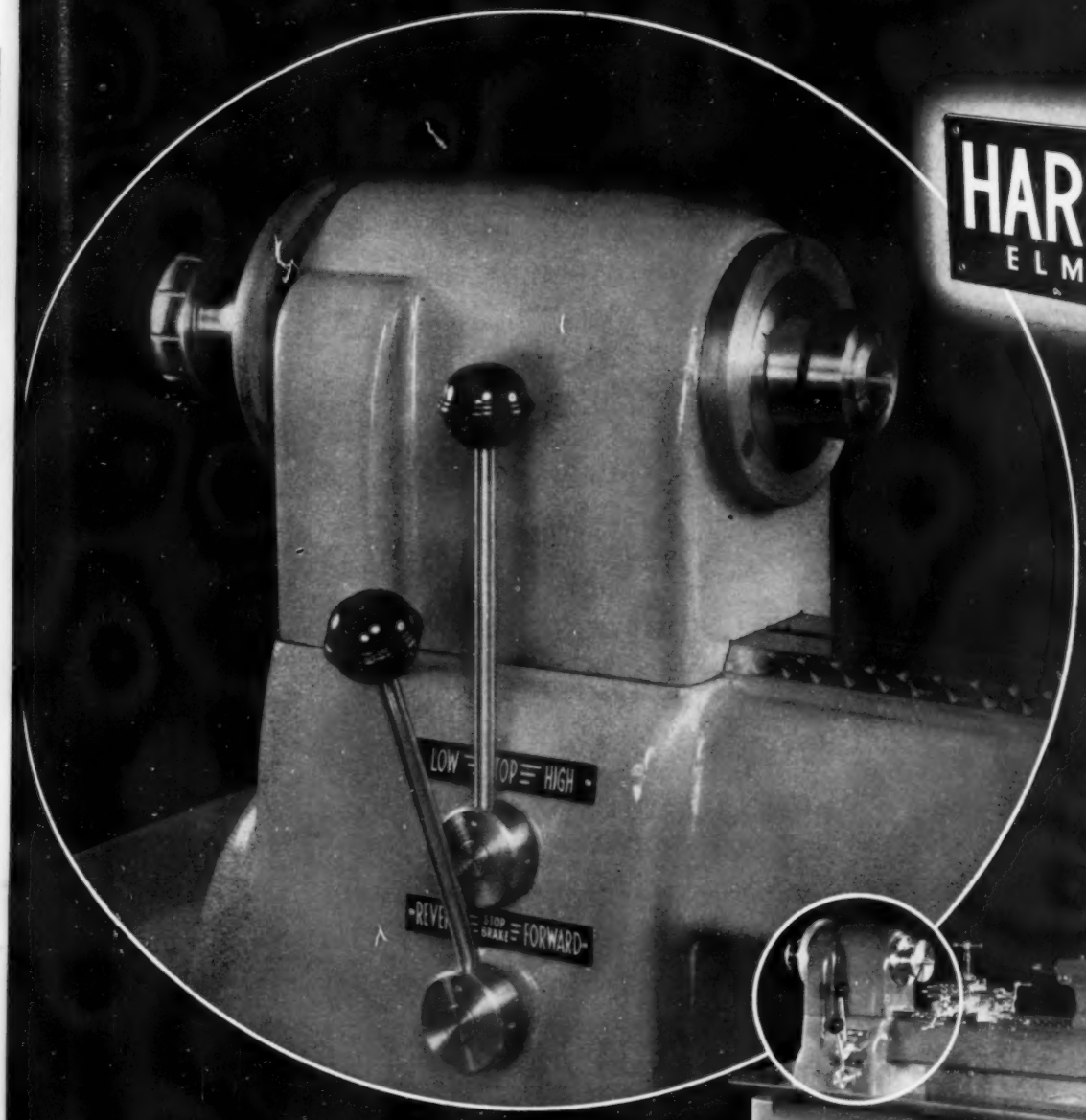
GENERAL MACHINERY CORPORATION

HAMILTON, OHIO

THE NILES TOOL WORKS CO.

THE HOOVEN, OWENS, RENTSCHLER CO.

GENERAL MACHINERY ORDNANCE CORPORATION



HARDINGE
ELMIRA, N.Y.

HARDINGE SPECIFICATIONS:
1" collet capacity
6" step chuck capacity
5" jaw chuck capacity
9" swing
36" bed
Lever speed control with spindle brake
8 speeds forward and 8 speeds reverse from 230 to 3900 R. P. M.

Convenience and Speed in Operation

Hardinge developed the use of two levers to operate electrical switches for changing precision lathe spindle speeds.

As illustrated, each lever has two speed positions only. The operation of each lever to a speed position is to a definite location. This means *convenience and speed* as the operator can concentrate his attention on the work. Concentration on work results in greater production and better workmanship.

Consideration of every detail characterizes HARDINGE machine design.

HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

Twist Drills—Milling Cutters —Reamers—Hobs—Slittings Saws—End Mills—Taps—Dies —Screw Plates—Profile Cutters—

THE TOOLS YOU BUY AGAIN

EVERY SMALL TOOL JOB IS AN OPPORTUNITY FOR A SAVING

Completeness of the UNION line makes it possible to realize BIG SAVINGS on many operations. Milling, drilling, reaming, hobbing, slitting, tapping, threading, cutting can be speeded up and costs reduced by these modern, fast, accurate tools.

Cost minded production men know from experience that UNION tools can always be depended on for economy and increased cutting efficiency over long periods between grindings.

Because of the wide range of tools in the UNION line, with each tool designed for maximum results, standardization on UNION tools can mean an overall total saving of substantial proportions. Put UNION tools to work and see for yourself.

UNION
TWIST DRILL COMPANY
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS
S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec

Representatives throughout the world

UNION

Soaring to New Heights
in RUGGEDNESS!
KEMPSMITH
NO. 2 PLAIN
TYPE G.
A BEAR FOR PUNISHMENT
Backed by 54 years of leadership in the industry, Kempsmith Millers have what it takes to meet today's gruelling war-time requirements. The straddle milling job, shown here, is a typical example. Two sides of heavy steel vise bodies are being milled simultaneously, on a standard No. 2 Type G machine. When it comes to sheer power, stamina and built-in ruggedness, you just can't beat a Kempsmith Milling Machine.
KEMPSMITH MACHINE CO.
MILWAUKEE, WIS., U. S. A.
KEMPSMITH

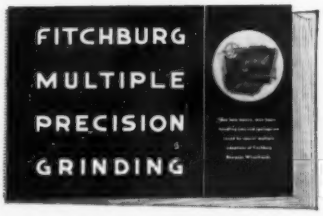
WHAT ABOUT
TOMORROW'S GRINDING COSTS?

You can cut tomorrow's costs with the Fitchburg Grinders you buy today.

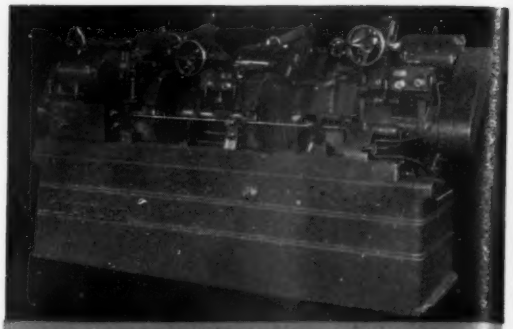
Fitchburg low cost method of mounting standard Bowgage Head Grinding Wheel Units for special single applications, or to multiple grind special jobs, will give you faster wartime production at lower cost, and leave you in a position to make rapid changeovers when the present emergency is over.

All Fitchburg Bowgage Head Automatic Precision Grinding Wheel Units are standard. They can be remounted on standard machines, or on new special bases, for operations other than the one originally specified. This feature protects your investment.

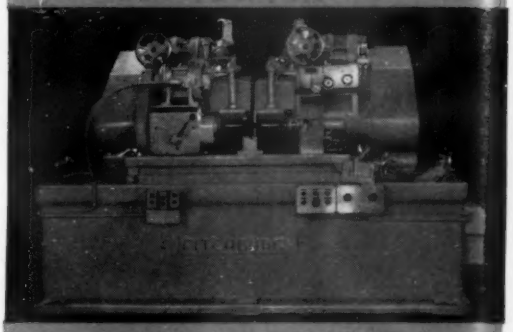
Save time and money — speed up cylindrical production grinding with Fitchburg Bowgage Heads.



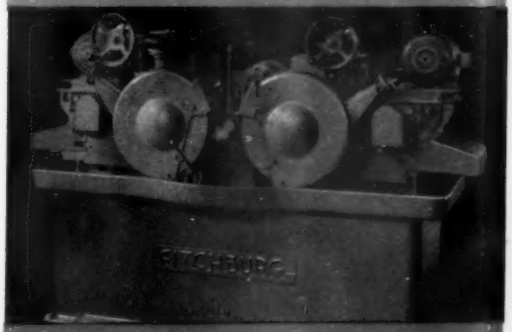
This Book shows how to cut grinding costs. . . . Free to executives. . . . Write for it today.



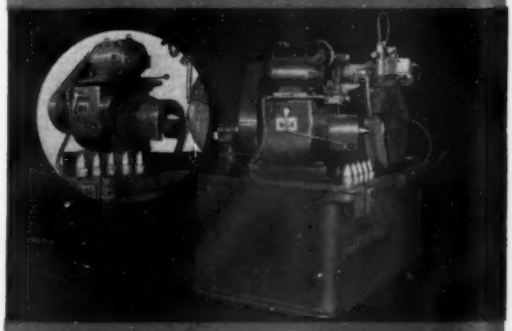
TRIPLE HEAD MACHINE



DOUBLE HEAD MACHINE



GEAR SHIFT GROOVE GRINDER



OJIVE GRINDER

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of — Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders

SAVE WITH AUTOMATIC MULTIPLE PRECISION GRINDING

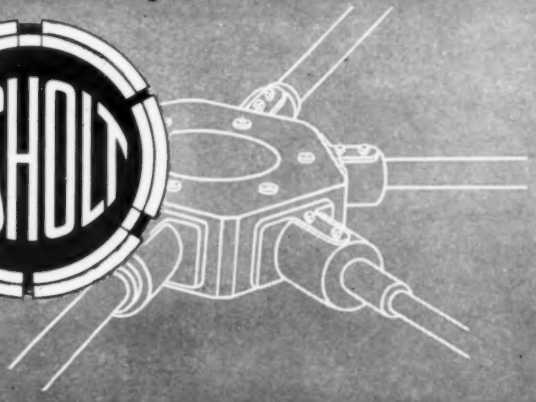
Make it fit to fight!

The American idea of mass production has created a world of interchangeable parts, one dependent upon the other. Wherever it is made—in your plant or in that of a subcontractor, the essence is accuracy. Machine tools like Gisholt Turret Lathes make this possible—assure the precision that makes parts fit to fight. Their proper use is vital to America—and to you.

GISHOLT MACHINE COMPANY · MADISON, WISCONSIN

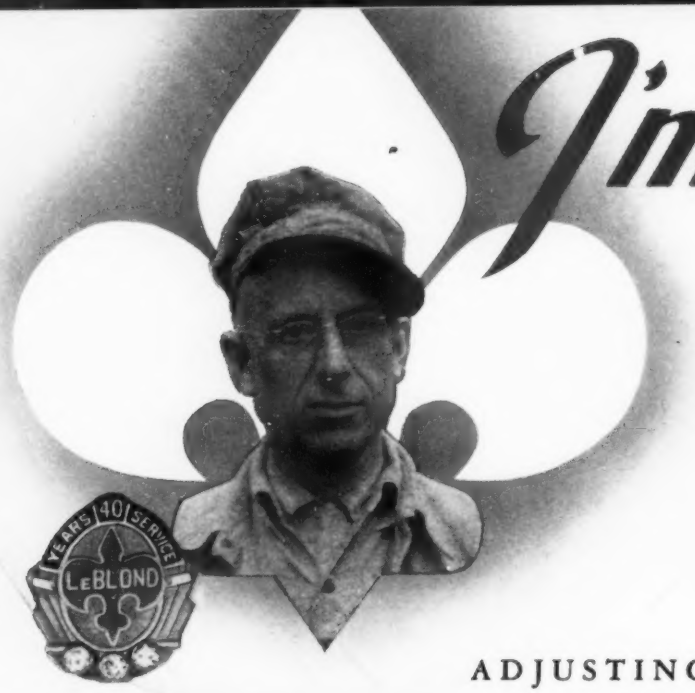
Look Ahead—Keep Ahead—With Gisholt Improvements in Metal Turning

GISHOLT



TURRET LATHES ★ AUTOMATIC LATHES ★ BALANCING MACHINES

I'm Tellin' You

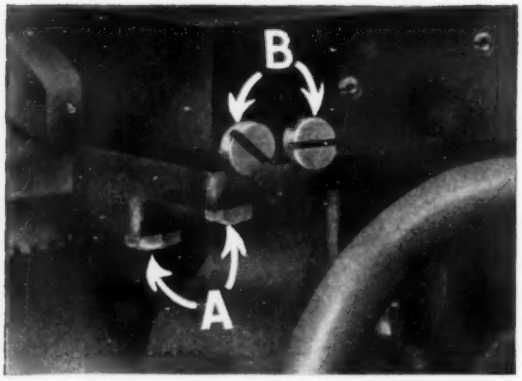


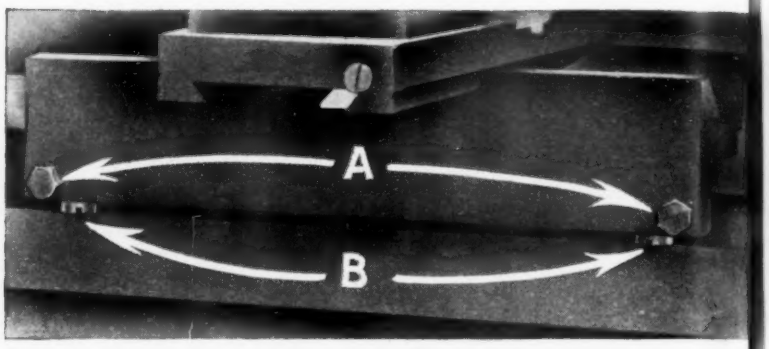
No. 6 in a series of tips on "Keeping 'em Turning"
by Charley Wetterer, 43 years at LeBlond.

"Clean your teeth twice a day and see your dentist twice a ye is a pretty good general rule. Lathe care would be a lot simp if we could set up some kind of slogan like that for adjustme But the schedule for lathe adjustment varies greatly with number of work hours per day, the kind of material machin regular or intermittent cut, condition of tools used, etc.

However, chatter in the work is a pretty fair sign that adjustme may be needed. The most common source of this kind of trou is slack in the bearings at these two points. Both are easily fi

ADJUSTING CARRIAGE GIBS





Each of the two front gibs on the carriage have a bearing on the side of the Veeway and are held in position by the two cap screws (A). Two adjusting set screws (B) hold the carriage gib firm against the side of the ways. To take up slack caused by wear on the bearings, loosen bottom screws (A), then tighten side screws (B) until you feel slight pressure of gib against the way. Now retighten bottom cap screws.

On the long gib in the rear of the carriage which does most of the work, the position of the cap and adjusting screws (B) are on the bottom. However, the procedure in relation to cap and adjusting screws is the same, i. e., loosen (A), tighten (B), then retighten (A).

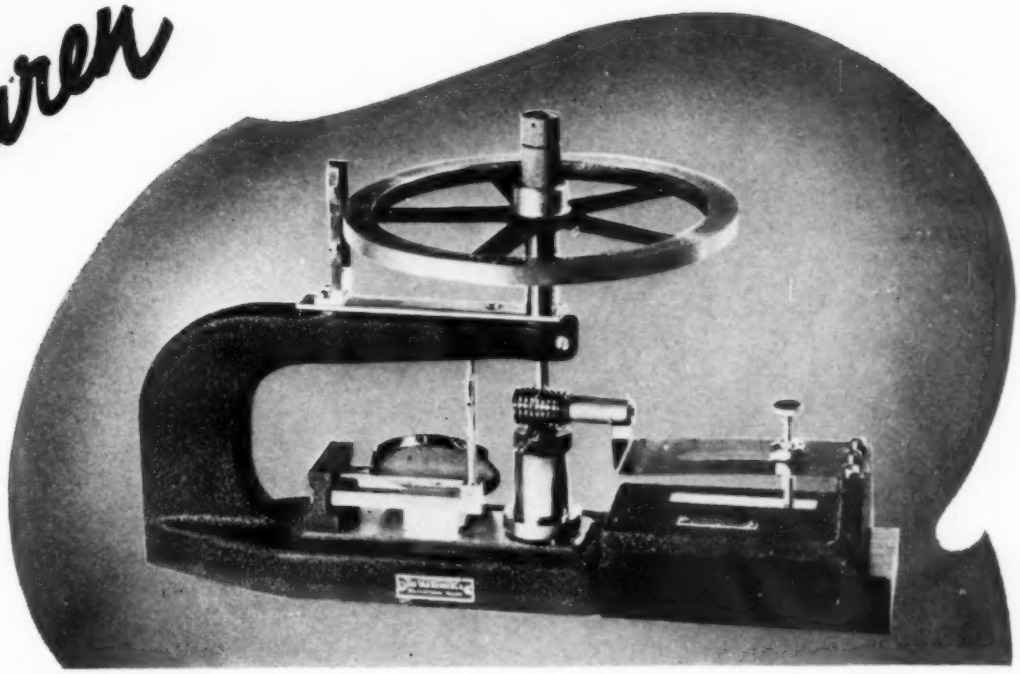
ADJUSTING SPINDLE

Wear in anti-friction bearings of the spindle is another cause of vibration of the work on old lathes. Here the adjustment procedure itself is simple, but is different for each type of lathe. For information on eliminating end play or longitudinal movement in your particular lathe, write me for easy instructions.

ARMY E NAVY

THE R. K. LeBLOND MACHINE TOOL COMPA
Cincinnati, Ohio
Largest Manufacturer of a Complete Line of La

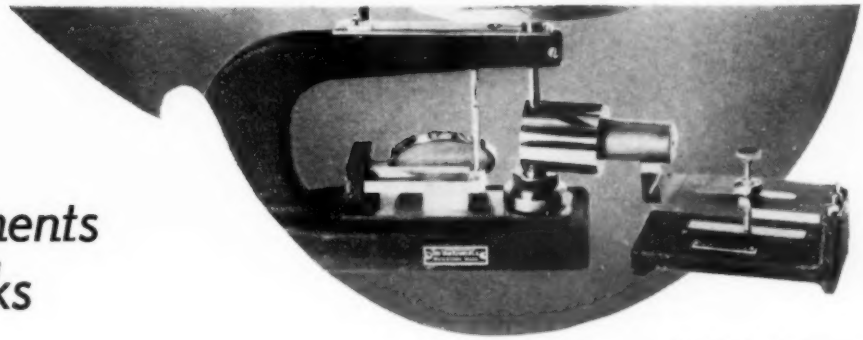
Van Keuren



Measuring the pitch diameter of a thread gage with the Van Keuren Light Wave Micrometer using the three wire method.

LIGHT WAVE MICROMETER

makes possible accurate measurements without gage blocks



Measuring a cylindrical plug gage with the Van Keuren Light Wave Micrometer. Note use of balancing stand in supporting large plug gage.

The Van Keuren Light Wave Micrometer is a complete direct-reading measuring instrument which will give results accurate within ¼" "tenth" (.000025") without the use of gage blocks. It is fast and easy to use and will eliminate errors caused by worn gage blocks.

The Light Wave Micrometer utilizes the sensitivity of light waves for controlling the pressure of measurement. This enables different operators to duplicate readings to .00001" and personal errors of feel or touch are eliminated. The micrometer head includes a hardened and ground precision micrometer thread carefully selected and calibrated in our plant. The instrument is furnished with a carboloy anvil which is practically indestructible. A calibration sheet is furnished for each instrument.

Van Keuren Light Wave Micrometers are recommended for checking measuring wires, plug gages and small precision parts of all kinds. They are ideal for making pitch diameter measurements of taps and thread gages by the three wire method. Other applications include the measuring of paper, leather, rubber, textiles, hair-springs, fine copper wire and other soft materials where only a light measuring pressure can be applied. Measurements can be made at any desired pressure from 0 to 2½ pounds.

Complete detailed information on this instrument is available in the Van Keuren Catalog Number 31.

THE Van Keuren COMPANY 176 WALTHAM ST., WATERTOWN, MASS.

Light Wave Equipment · Light Wave Micrometers · Gage Blocks · Taper Insert Plug Gages · Wire Type Plug Gages · Measuring Wires · Thread Measuring Wires · Gear Measuring System · Shop Triangles

NAVY
Cincinnati, Ohio
Largest Manufacturer of a Complete Line of La

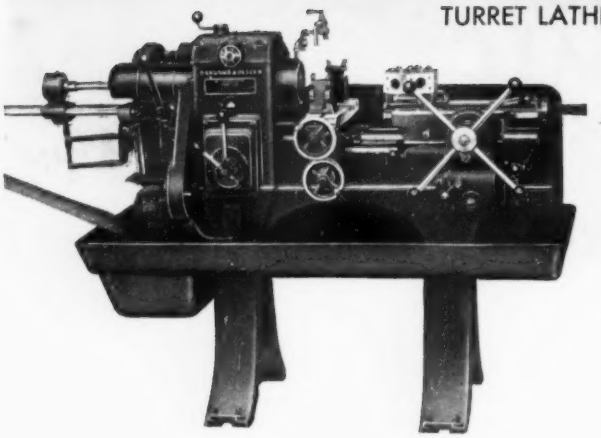
Bardons AND Oliver

NO. 2 GEARED ELECTRIC TURRET LATHE

for Ease of Operation . .

On production of small parts, whether from bar, forging, or casting, THE EASE OF OPERATING the turret lathe is of paramount importance. This is truer today than ever before as more and more women are finding their places in industry.

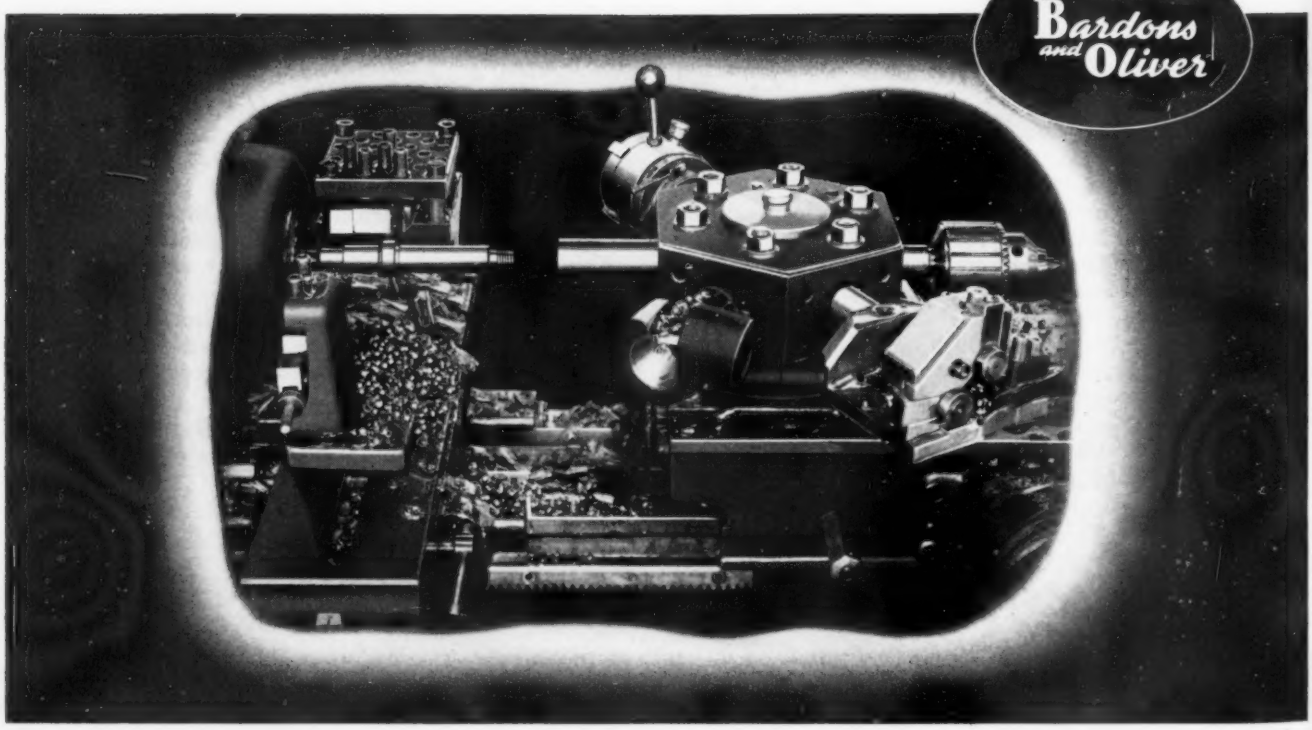
Here are a few of the features that make the No. 2 GEARED ELECTRIC TURRET LATHE outstanding in its field:



- **Single lever electric start—stop—reverse in combination with single lever electric high-low speed change.**
- **Single lever control with direct reading dial for six geared spindle speed changes.**
- **Direct reading six feed change dial with single lever control.**
- **Automatic turret clamp with automatic wear compensator.**
- **Tool carrying slides and controls responsive to light sensitive touch.**

So, if you are interested in EASE OF OPERATION, let us give you further information.

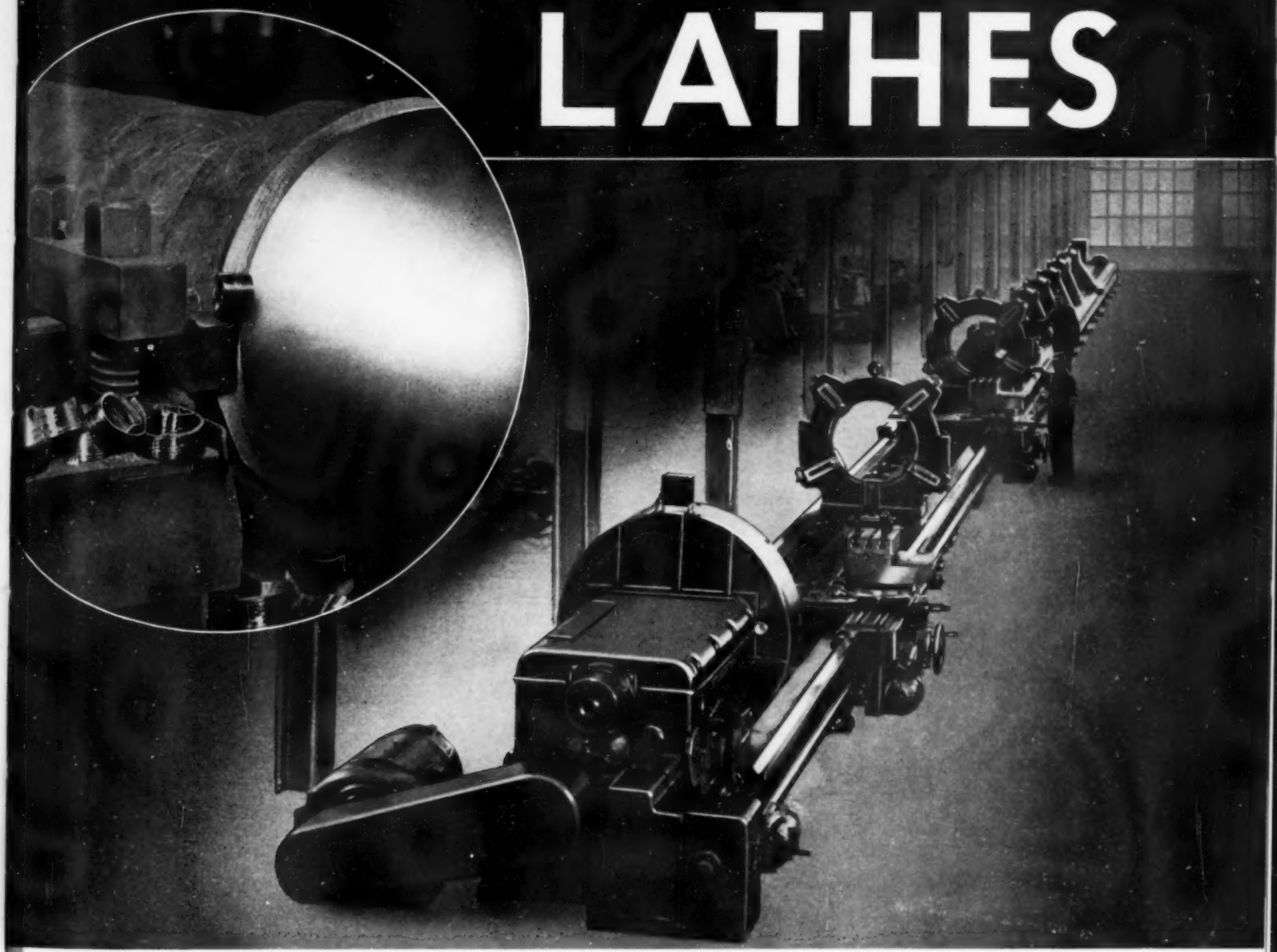
BARDONS & OLIVER, INC.
1133 W. 9TH ST. . . CLEVELAND, OHIO



BETTS-BRIDGEFORD

HEAVY DUTY GEARED HEAD

LATHES



Betts-Bridgeford Heavy Duty Lathes are designed for taking heavy cuts with carbide tools and are built to maintain their accuracy even under extreme conditions and throughout their long life. They have the same rugged dependability for which Betts-Bridgeford Machines have long been noted, plus every modern improvement for convenience of operation and speed in production.

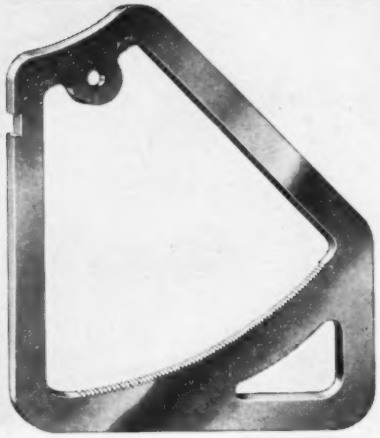
These Lathes are built in sizes from 26" up, the largest of which will handle work of 12' diameter. They are also available in various types suitable for almost any requirement. Send us your next Lathe inquiry.

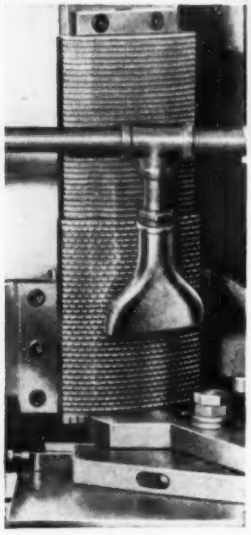
BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK

LINES BEHIND THE LINES

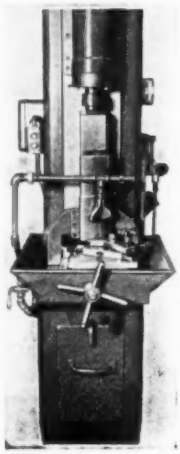
"ALL THIS AND TIRES TOO!" SAYS THE 100% CONVERTED RUBBER INDUSTRY, NOW MANUFACTURING IMPLEMENTS OF MECHANIZED WAR





BROACH DESIGNED, with special engineered clamping and holding fixture, by *American* (left), finishes radius and cuts teeth with one pass of the tool.

BROACHING MACHINE (right), *American* made V-1½-4 ton, reduces set-up, loading, and operating time — does a precision job at a production rate!



BY SPEEDILY CONVERTING part of its plant to the manufacture of guns and other munitions, rubber eminently deserves credit as one of the production lines behind the firing lines. Noteworthy is the industry's recognition of broaching as a better way to do many metal-working jobs — the only *right* way to do some!

* * * *

TEETH IN GUNNER'S QUADRANT *(left)* are one of the forms which only broaching can do with the speed and precision required.

BROACHING IS BETTER THE *American* WAY

American

BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

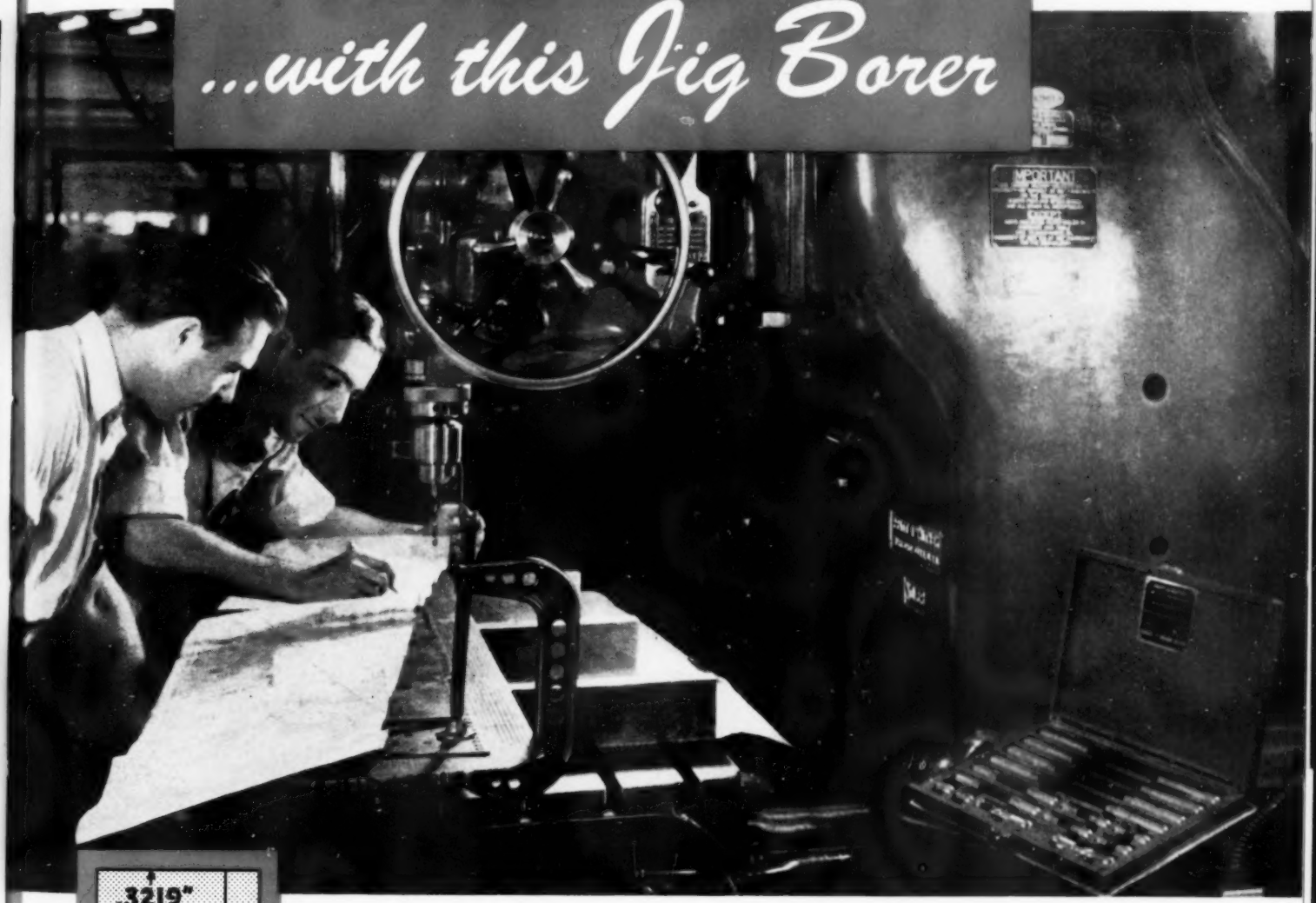
•

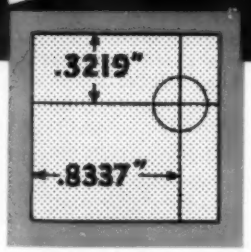
BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF

You could bore at any one of 100 million points in a square inch

...with this Jig Borer





TO make sure you have available all the precision you *do* want, Pratt & Whitney builds into this jig borer a degree of accuracy you'll probably seldom need.

Let's say you're making a jig, and want to bore a hole at a known point. With the P&W Jig Borer, you *could* work to *four decimal places* . . . take your choice of 100 million points in any square inch . . . not just on paper, but *right in the cold metal itself* . . . if you control such variables as temperature and tool wear.

The P&W Jig Borer is one of many Pratt & Whitney products that provide *basic accuracy for mass production*. It can split the linear inch into 10,000 equal parts. It locates, bores, and then checks its own work. From the operator's standpoint, the most important guarantee of accuracy is the pair of dial indicators; once zeroed to a given position, these show at a glance any change from original setting . . . at any stage of the job. Results: speed, precision, less spoilage.

You may seldom work to the last "tenth." But for sure, dependable *basic accuracy* under all working conditions you'll be wise to invest in this *real* jig borer that imposes no limit on your precision.

Call on Pratt & Whitney. Details of P&W Jig Borers will be supplied on request.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

fly the "E" pennant for high production.

Horton chucks

INDEPENDENT Solid Reversible Jaws Only

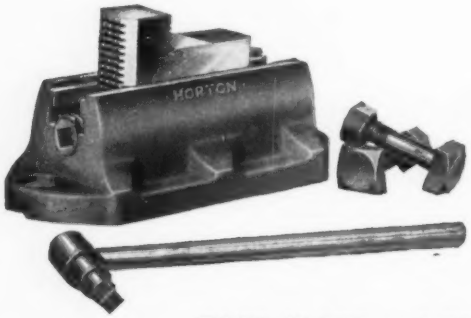
SCROLL UNIVERSAL Two-Piece Jaws Only

For Use With Intermediate Plates On Threaded Spindles

For Key Drive Tapered Nose Spindles

War Production
Limited To These
Essential Chucks

For Flanged Tapered Nose Spindles
Illustration shows chuck for Type D (Cam Lock) Spindle



HORTON
MORROW

FACE PLATE and BORING MILL JAWS—Steel Body Only

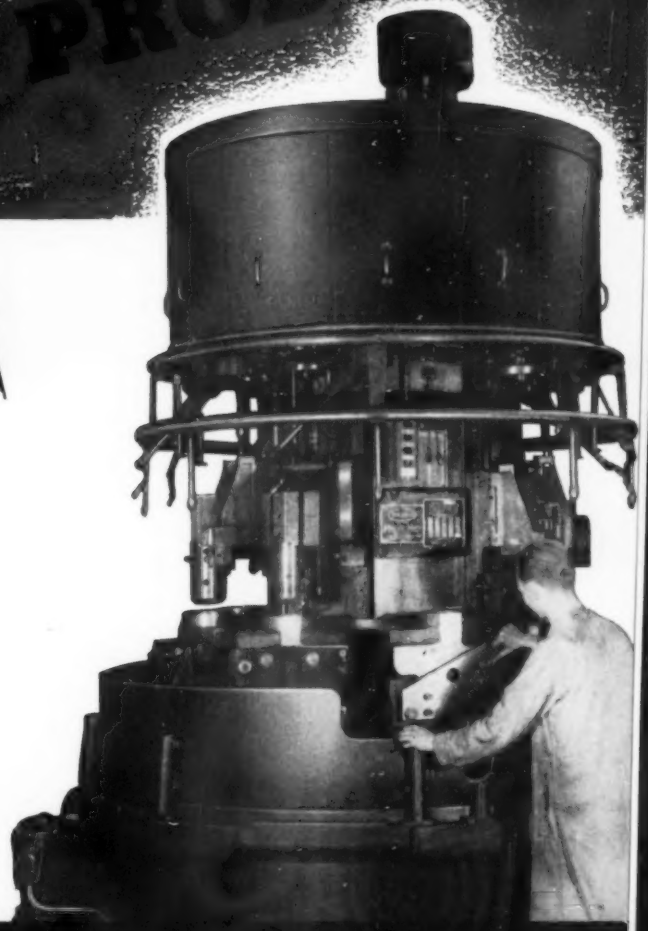
SINCE 1851 .... THE E. HORTON & SON CO.
WINDSOR LOCKS, CONNECTICUT, U. S. A.

WEST HARTFORD • CONNECTICUT

fly the "E" pennant for high production.

ARMY E NAVY

THE POWER TO PRODUCE



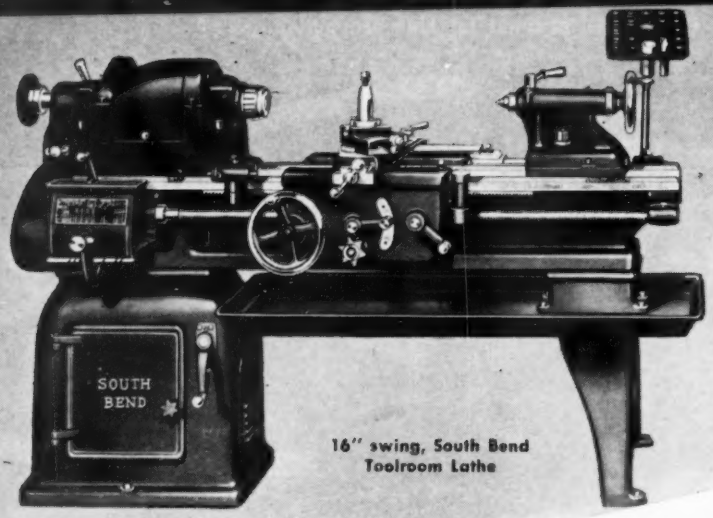
To win this war every bit of raw material must be used, every kilowatt of power, every foot of production floor space, every minute of every day, every bit of strength of every citizen.

To do our present best is not enough if by new means, new methods, our best can be more effective. Here is an example of what we mean. Recently three Bullard Mult-Au-Matics replaced 18 other machines on a certain job in an aeroplane engine plant. The change saved 15 machines, a great deal of money, and most important of all, released 8 men per shift for other sorely needed work.

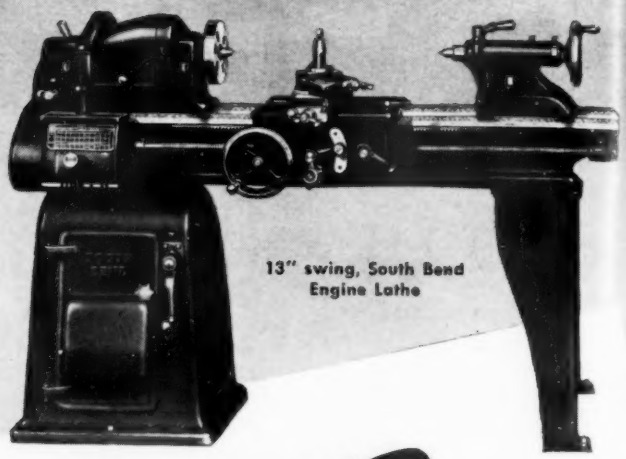
Bullard Mult-Au-Matics and Bullard V.T.L.s have the power to produce, the power to make *your best* even better.

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT



16" swing, South Bend
Toolroom Lathe



13" swing, South Bend
Engine Lathe

SOUTH BEND LATHES

Engine Lathes · Toolroom Lathes · Turret Lathes

Time, material and manpower can be saved for vital work if you use the *right* lathe for every job. The matching of the job and the lathe has never been more important than it is today—in no other way can maximum production be obtained. Remember that versatility and precision are important in a toolroom lathe. For manufacturing operations, a lathe must also have plenty of power, speed and stamina.

South Bend Lathes are made in sizes and types that will efficiently handle a wide range of work. The Engine Lathes and Toolroom Lathes are made with 9", 10", 13", and 16" swings. The Turret Lathes have 9", 10", and 16" swings. A copy of Catalog 100B describing these lathes will be sent upon request.

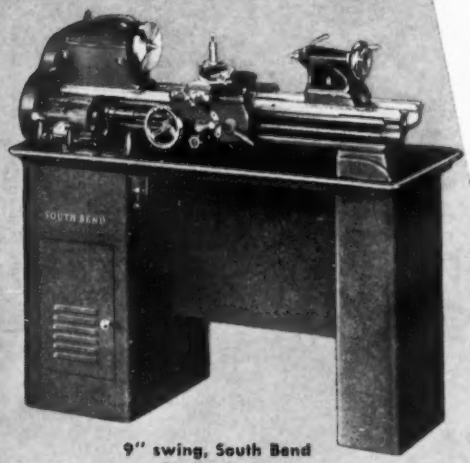
SOUTH BEND LATHE WORKS

South Bend, Indiana, Lathe Builders For 36 Years

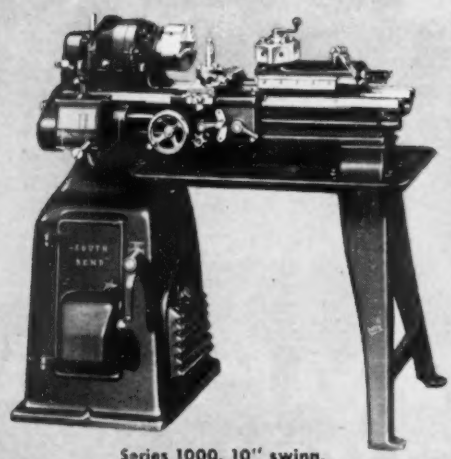
TRAINING HELPS

Write for Circular 21-C describing South Bend Training Helps—sound films, books, charts and bulletins on lathe operation.

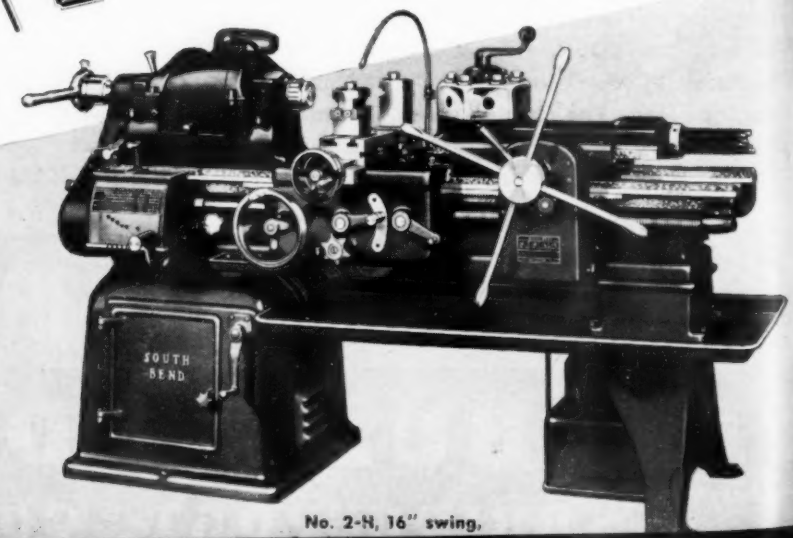
10" swing, South Bend
Engine Lathe



9" swing, South Bend
Engine Lathe



Series 1000, 10" swing,
South Bend Turret Lathe



No. 2-N, 16" swing,

FOSDICK

JIG BORER

● **Fosdick Jig Borers because of their extreme versatility are handling heavy production schedules in some war plants and operating with equal efficiency on small lots in others.**

Here's a medium priced machine tool that is being used successfully on a variety of operations and does not require expensive jigs or fixtures. In many instances comparatively unskilled help is maintaining high production and close tolerances on several different jobs.

This specific operation calls for the boring of 4 piercing holes in a steel stamping die and is held to very close limits. It is typical of the type of work being universally handled on Fosdick Jig Borers.

WRITE

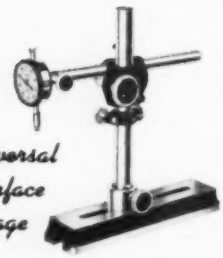
for Jig Borer bulletin J. B. A. for complete details.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI ... OHIO

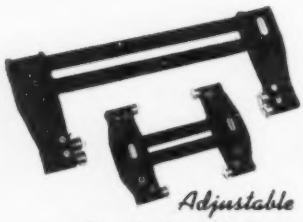
STANDARD Gages

Dial Bore Gage

Snap Gage



Universal Surface Gage



Adjustable Limit Length Gage

Master Disc

Special Gage

Adjustable Limit Pin Gage

Dial Indicator

Dial Plug Gage

Cylindrical Plug Gage

Dial Snap Gage

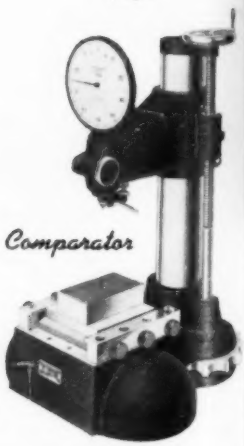
Test Indicator

Adjustable Limit Plug Gage

Cylindrical Ring Gage

Depth Gage

Dial Pin Gage

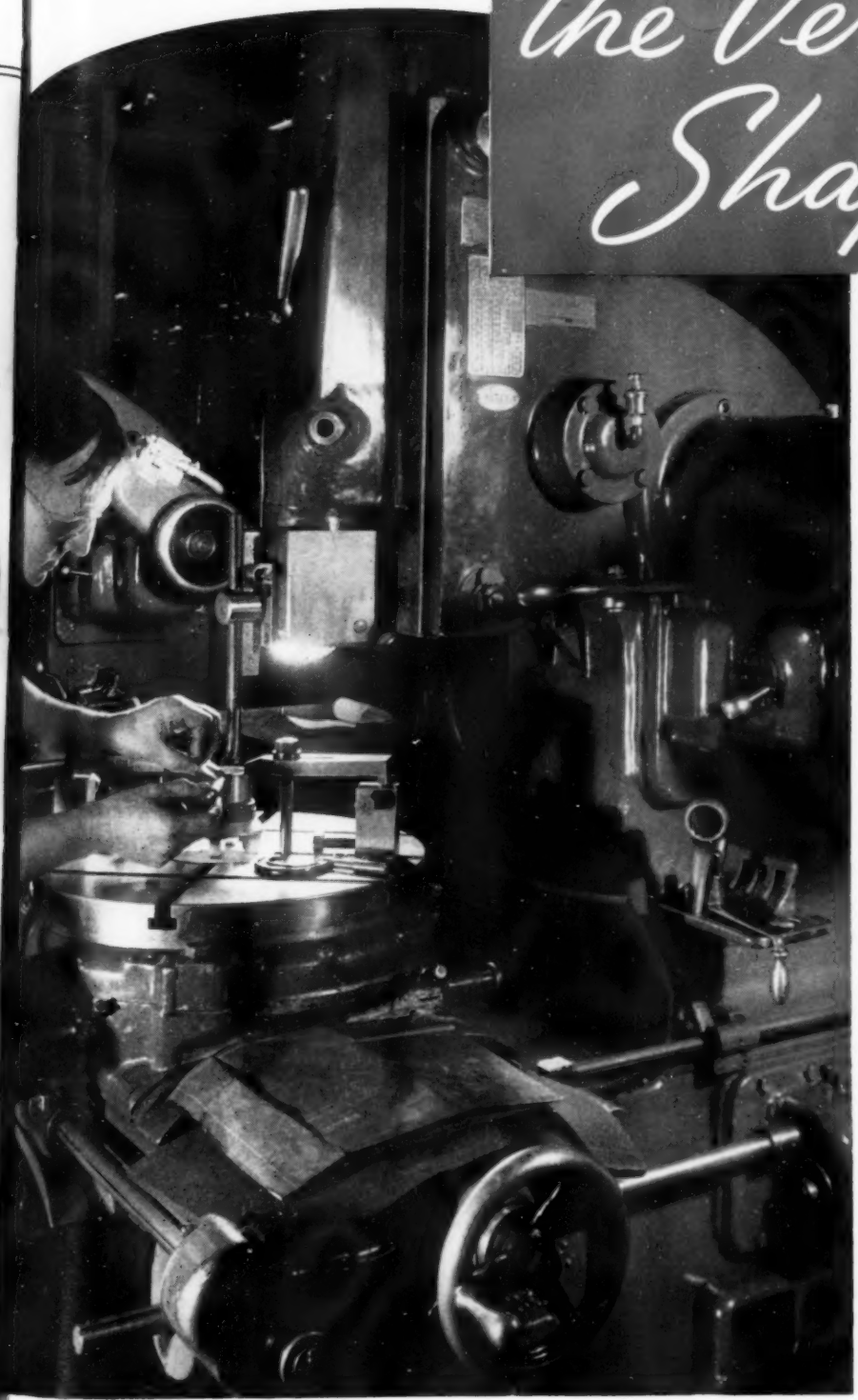


Comparator

STANDARD GAGE CO., INC. —— POUGHKEEPSIE, N. Y

"The handiest machine in the shop . . ."

the Vertical Shaper



HERE'S a machine that's the pride and joy of any good machinist who has it available. For it has an almost-human *adaptability*. It handles a vast variety of irregular shapes with a rock-bottom minimum of set-up changes. No mere slotter, it combines simple flexibility of work-holding and adjustment with refinements of non-overhanging tool head and extremely smooth ram motion.

For this is the P&W Vertical Shaper — one of many Pratt & Whitney products that provide *basic accuracy for mass production*. In tooling, it finishes complex box jigs and other high-precision fixtures. In die-making its angular ram adjustment is a welcome extra feature that permits direct machining of reliefs. It's ideal for repair work, and for small-lot production. The P&W Vertical Shaper makes tough jobs simple; its owners report they find new uses for it every day.

If you need basic accuracy for mass production, call on Pratt & Whitney. There is no better-paying investment than the right tools for each job. Details of the P&W Vertical Shaper will be supplied on request.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

Idle Cutting Tools!—Report For *ACTIVE DUTY!*

THE necessary diversion of a substantial portion of the available tungsten supply to war uses is causing, *and will continue to cause,* a shortage of High Speed Steel. As a result, manufacturers of cutting tools are not able to make full use of their facilities. Manufacturers of war materiel are, in consequence, suffering from needlessly long cutter deliveries, and are not able to make full use of *their* manufacturing facilities. This is a *very real situation,* not the product of someone's guess work or imagination; and it stems from an unavoidable shortage of tungsten. But, fortunately, there *is* a cure for that shortage — though it requires *your* cooperation and a willingness to give up something of value in order to help the other fellow . . .

TURN IN
TO THE STEEL COMPANIES
ALL YOUR IDLE
HIGH SPEED STEEL
CUTTING TOOLS

You undoubtedly have a quantity of High Speed Steel milling cutters, drills, reamers, hobs, and other cutting tools in live storage — tools that are still good but have not been used for some time, and will not be needed in the near future. Please turn these tools in immediately as scrap metal! The steel companies can recover the vital tungsten from this material and use it to increase the supply of High Speed Steel in quick order. As has been said of some other items: "When we win this war, you can get plenty of cutting tools; if we lose it, you won't need them." Sure, it's asking you to sacrifice unused value — but that steel will be of a lot more immediate value producing shells and guns than gathering dust in your tool crib.

V

Machine and Small Tool products of Barber-Colman Company are working in countless ways to forward the war effort. Our Field Engineers are at your service to assist in obtaining maximum efficiency and production from your B-C machines, hobs, cutters, and reamers. Call on this help whenever you need it.

BARBER B-C COLMAN PRODUCTS
MILLING CUTTERS, HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.

YOU TELL US

what your honing problem is

— and we'll build a stone to solve it!

Honing and superfinishing stones that are meant to do the surface finishing job you have a right to expect of them are not tossed over a counter like khaki to a rookie. At least, that's not the way MID-WEST honing stones are distributed.

MID-WEST engineers, who are experts in the comparatively new practice of honing and superfinishing, realize there is no quicker way to lose a customer than to ship him a stone that will not do his honing job — or will not do it with the speed and efficiency he demands. In this day of high production requirements, extremely close tolerances and smoothness standards undreamed of a few years back the word "approximate" simply will not do. Precision is demanded in war tool production and precision, to an even greater degree, will be demanded in the peacetime production to follow.

MID-WEST honing stones are precision made for precision purposes. They are "tailor-made" to do specific honing jobs and do them quickly and efficiently. Let one of our engineers study your honing problem and recommend a stone to do your job. If we don't have a stone that will solve it, we'll *build* one for you. Just write or wire. We'll do the rest.

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE — DETROIT, MICHIGAN

Mid-West

- ★ *Honing Stones*
- ★ *Superfinishing Stones*
- ★ *Grinding Wheels*
- ★ *Emery Cloth*
- ★ *Sandpaper*

Mid-West Abrasive Company,
1960 E. Milwaukee Avenue,
Detroit, Michigan

Gentlemen: Please send me additional information on Mid-West Micro Bond honing and superfinishing stones.

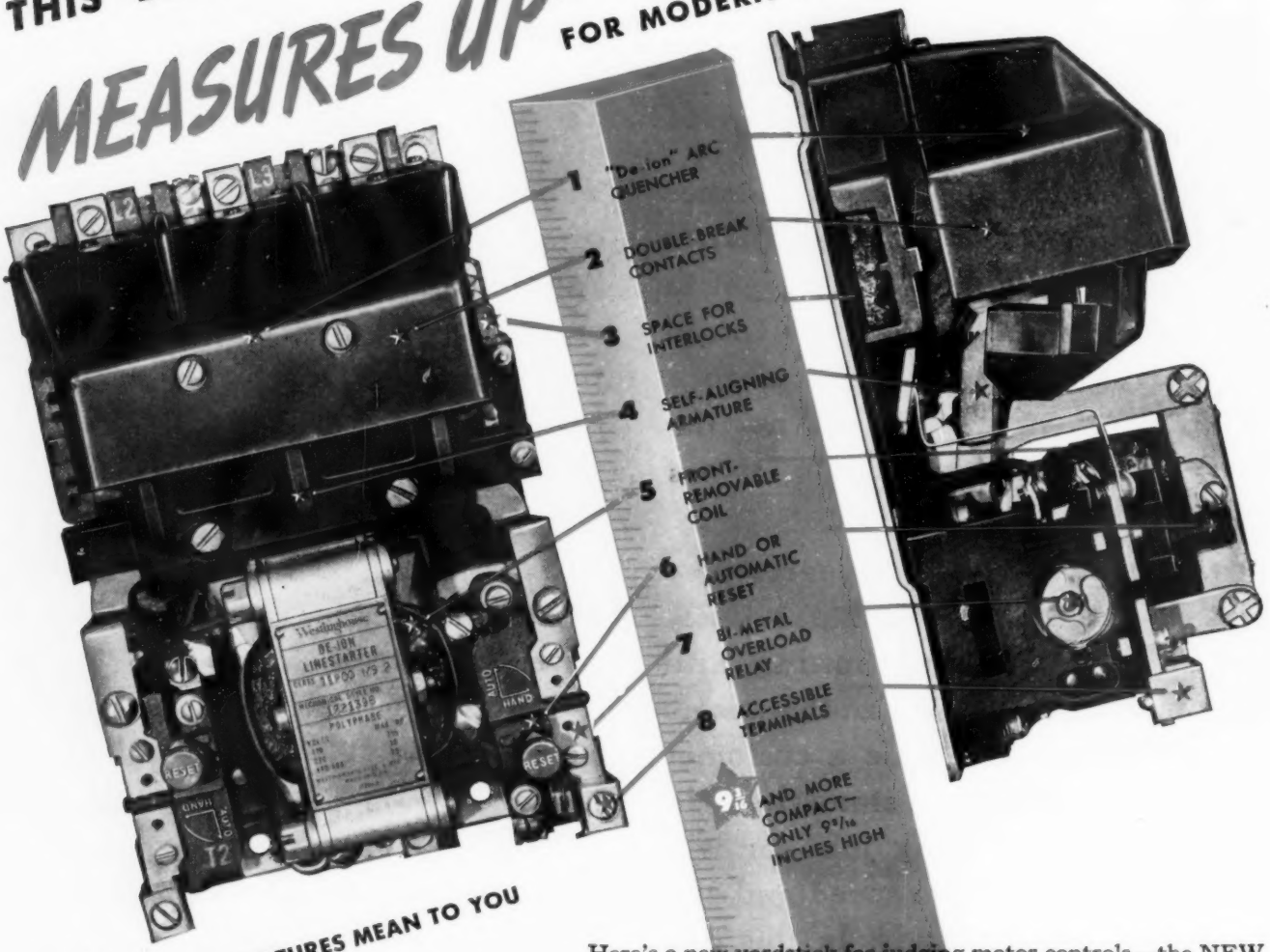
Name _____

Company _____

Address _____

_____

THIS NEW SIZE 2 LINESTARTER MEASURES UP TO ALL REQUIREMENTS FOR MODERN MOTOR CONTROL SYSTEMS



WHAT THESE NEW FEATURES MEAN TO YOU

1. "De-ion" action quenches the arc, prolongs contact life.
2. Double-break contacts eliminate shunts which fray and break.
3. Interlocks—as many as four—can be easily added.
4. Armature keeps true alignment of contacts, does not "wobble" with age.
5. Operating coil easily changed—front removable.
6. Overload relay may easily be made manual or automatic reset.
7. Bi-metal overload protection assures unchanging accuracy. Size 2 heaters are interchangeable with sizes 0 and 1.
8. Speeds installations . . . "straight-through" wiring.
9. Simplified design for group mountings.

Here's a new yardstick for judging motor controls—the NEW Westinghouse Size 2 Linestarter. It's totally new—redesigned to meet the space and operating requirements of today's machines.

Over-all dimensions are now smaller—making it ideal for group mountings and built-in applications. Yet there's no crowding—all parts and terminals are easily front-accessible.

The overload relay may be made either manual or automatic reset simply by twisting the relay reset button—nothing to remove or adjust.

In addition, this new unit has many other exclusive Westinghouse advantages. There's the safety of "De-ion" arc quenching and the dependable accuracy of Bi-metal overload protection. Write today for Bulletin 3185, giving complete details on the new Westinghouse Size 2 Linestarter. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-21253

Westinghouse **MOTORS AND CONTROLS**

. . . OUR MEN NEED THE BEST

Awarded to Auto-Ordnance Corporation for excellence in production of "Tommy Guns."

TRADE-MARK
Thompson
REG. U.S. PAT. OFF.

Can be used on machines No. 9 and No. 10 Brown and Sharpe Standard Taper as well as No. 2 Morse Standard Taper.

Thompson · SPRING COLLET ADAPTER

The Thompson Spring Collet Adapter helps to produce the best — efficiently, accurately. Our men and women in the shops must have the best in order to produce the best for our fighting men — that's important. • Consisting of only two parts, the "Thompson" is sure gripping — eliminates heavy, bulky chucks — brings work in closer proximity to work. • Specify "Thompson" and produce the best.

AUTO-ORDNANCE *Corporation*

THOMPSON TOOL DIVISION

42 WEST PUTNAM AVENUE, GREENWICH, CONN.

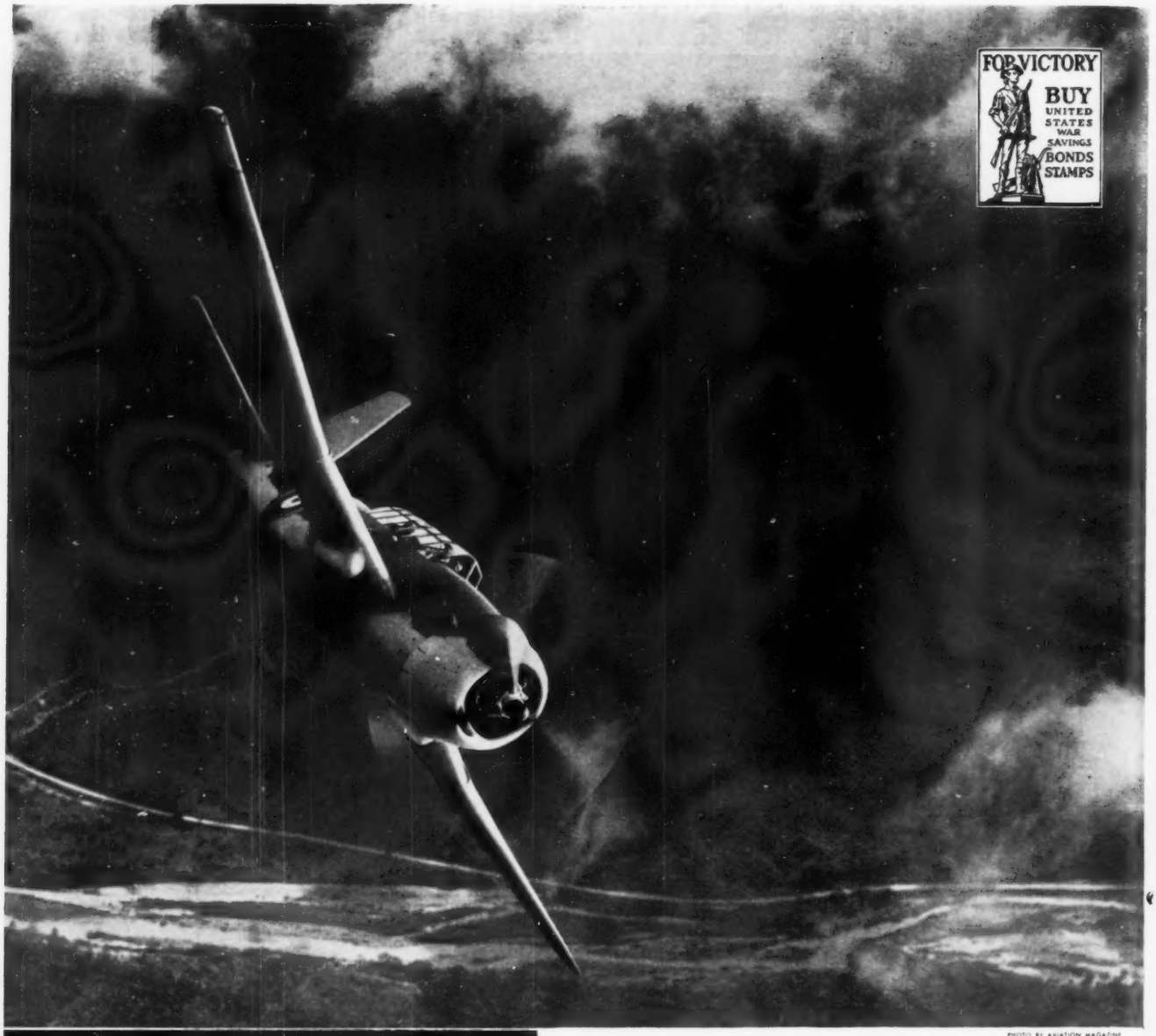
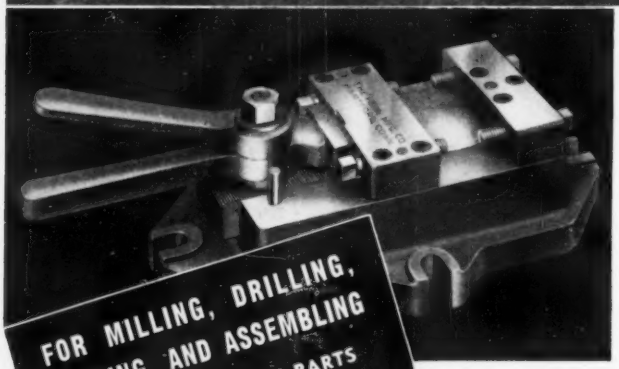


PHOTO BY AVIATION MAGAZINE



FOR MILLING, DRILLING, TAPPING, AND ASSEMBLING

AIR PLANE ENGINE PARTS
MACHINE GUN PARTS
AUTOMOBILE PARTS
ELECTRICAL EQUIPMENT
TOOL MAKING
PRECISION INSTRUMENTS
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BOMB LOADS FOR VICTORY

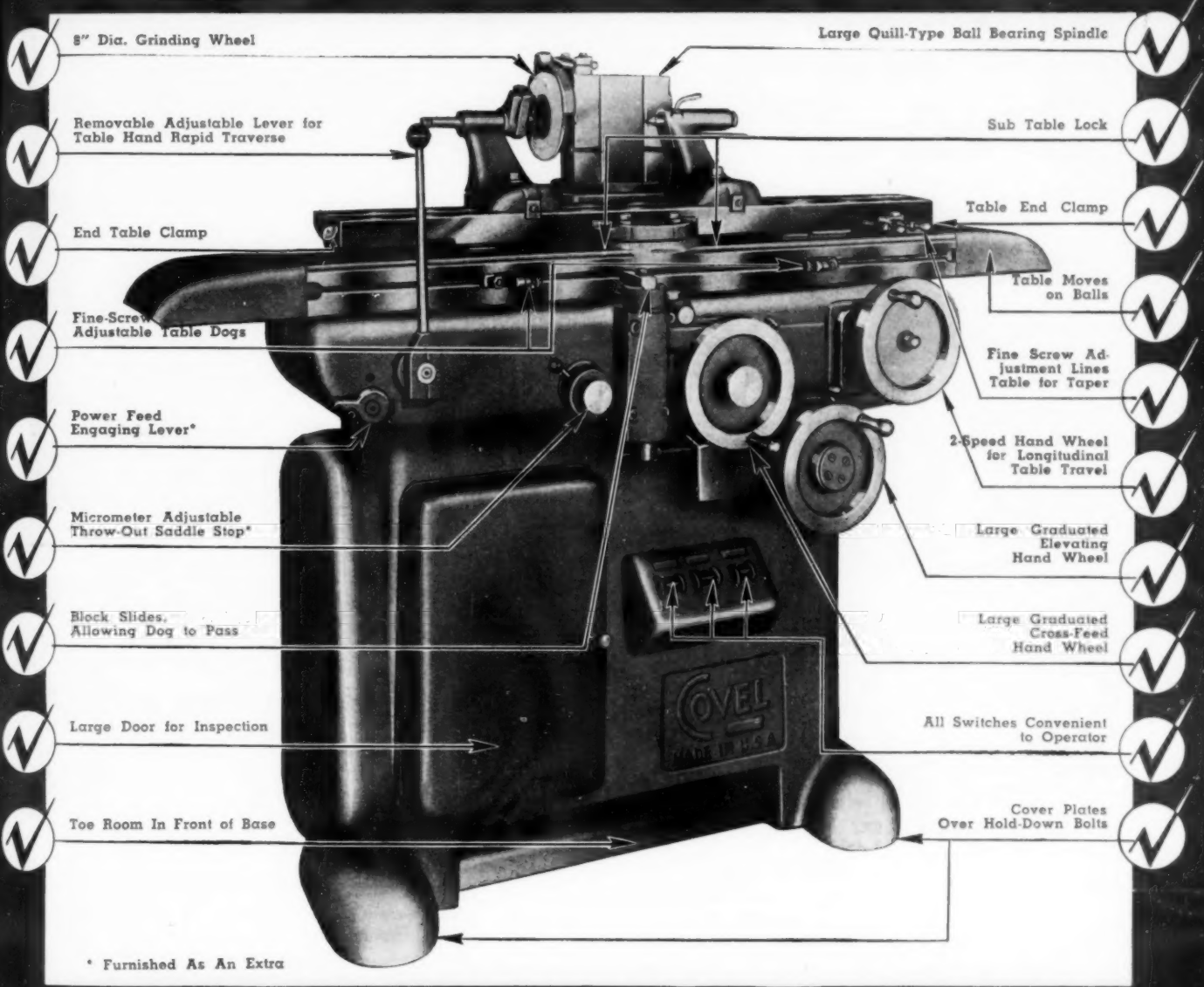
Fenn Quick-Action vises are in the thick of the fight for production in many a war factory.

Here is a precision built vise with a bull-dog grip and a quick-action mechanism for volume production. For milling, drilling, tapping and assembling operations in small parts production it is unexcelled. Three sizes: 4" - 5" and 7". Send for Specification Bulletin.

The FENN MANUFACTURING CO.

Established 1900 HARTFORD, CONNECTICUT

Check ✓ these Superior Features of the Number 22 COVEL UNIVERSAL CUTTER & TOOL GRINDER


8" Dia. Grinding Wheel
Removable Adjustable Lever for Table Hand Rapid Traverse
End Table Clamp
Fine-Screw Adjustable Table Dogs
Power Feed Engaging Lever*
Micrometer Adjustable Throw-Out Saddle Stop*
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All Switches Convenient to Operator
Cover Plates Over Hold-Down Bolts
COVEL
MADE IN U.S.A.

* Furnished As An Extra

Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.

the light metal age is born . . .

The Stone Age, the Bronze Age, the Iron Age, the Steel Age — these four great ages span the history of man.

Today, we are at the dawn of a fifth. Out of this war, the greatest conflict the world has ever known, the Light Metal Age is being born.

Magnesium is one of the lightest metals known. One pound will do the work of one and one half pounds of aluminum and five pounds of copper, and magnesium alloys have been developed with an ultimate strength of more than 60,000 pounds per square inch.

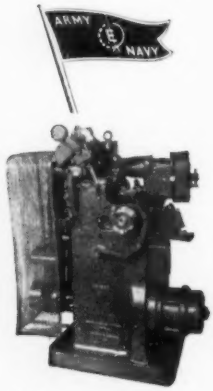
Before the war there was only one magnesium and one aluminum producer in the United States . . . after the war there will be as many as ten magnesium producers and four aluminum producers! What's more, these metals are among the most abundant of all, and full production should reduce the prices of both to levels never dreamed of before.

Likewise in steel, in just two war years our capacity for electric-furnace steel has increased an incredible 85%, and new lightweight superstrength alloys have been developed which can now be welded, with great savings in costs and time.

What does all this mean to the post-war world just ahead? It means that aircraft, automobiles, trucks and trains will be lighter, stronger and cheaper. It means that rivetless ships will slide off the ways, and rivetless planes will roll off the lines. It means greater speed and lightness and strength and economy.

And it means *problems!* Problems in production, in fabrication, in tooling and in design. Problems in the new light metals of the new Light Metal Age!

Bryant engineers are among the foremost authorities in America on problems involving machine tool operations with the new light metals. Send us *your* problems now!



SEND FOR THE MAN FROM BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U.S.A.

Plan for a Long War— Work for a Short One!

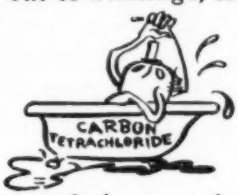
No one can say how long this war will last. But maintenance can say how long America's *motors* will last... and how efficiently they will work to help *shorten* the war!

MAINTENANCE "as usual" went out with Pearl Harbor. Today, every U. S. maintenance man knows he's pitted against a Jap or Nazi maintenance man. He's got a man-sized job...

For example, if the current in a motor exceeds its nameplate current rating, heating may increase as much as the *square* of the current increase! And when a motor runs a fever, there's trouble ahead...

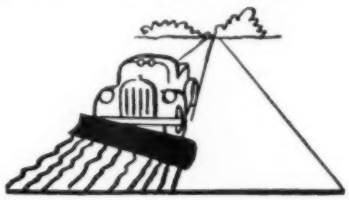
Excessive heat can "fry" the life out of insulation, melt soldered connections, burn out bearings. That's why a close eye must be kept on every motor's overload protection.

Friction is another dangerous source of heat — so the right lubricant in the right amount must be kept *in* bearings and dust must be kept *out!* For cool-running motors, dust must be kept out of *windings*, too...



If compressed air or suction doesn't get the dust out, it's necessary to give the dirty motor a "bath". *Promptly*, too — because the rim travel of a rotor in many motors today is round the world *every eight days*...

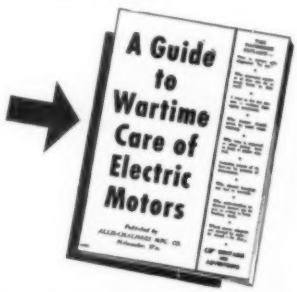
Some job to keep motors rolling at that rate — for the duration!



Just as "rutting" is fought in road maintenance, "grooving" must be fought in *motor* maintenance. Some wear is inevitable on slip rings and commutators, of course. But *smooth and even* wear is *slow* wear!

"Keep oil where it belongs" is a basic rule in maintenance. Once outside bearings, it attacks any insulation it reaches. *Inside* bearings, oil must be protected against misalignment pressures...

The oil film guarding a bearing often is no thicker than the wall of a soap bubble... can fail just as suddenly — *and completely!*



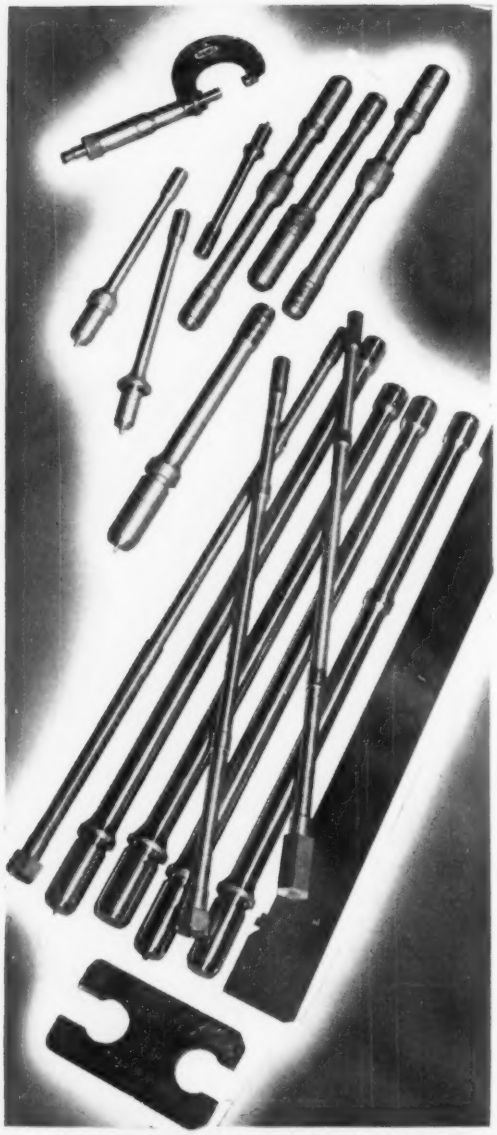
For the full story of what *today's* maintenance should be, send for your free copy of "A Guide to Wartime Care of Electric Motors." It's fully illustrated (with the sketches above and many more), practical, complete. ALLIS-CHALMERS MFG. CO., MILWAUKEE, WISCONSIN.

A 1553

ALLIS-CHALMERS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

PACKARD MOTOR USES BATTERIES OF MODEL B CLEVELAND *Single Spindle* AUTOMATICS TO PRODUCE AIRCRAFT ENGINE STUDS RAPIDLY



• Perhaps in no other industry has the Model B Cleveland *Single Spindle* Automatic been given so much responsibility for a vital war production job as at Packard Motor Car Company, "on the toughest job we ever tackled," says Packard. Here the problem of producing studs accurately and quickly for the famous Rolls Royce aircraft engine has been solved by using Model B Cleveland for just that one purpose—in step with American production methods and yet with Packard precision standards always in mind.

A large number of Model B Clevelands are on the job, and Packard production men have indicated their entire satisfaction with Model B performance by ordering more for future delivery.

Typical of the work is the production cycle for one of the Rolls Royce engine studs shown, produced from 1⅜-inch bar stock. Operations include turning long undercut, turning stud end, forming, chamfering, small undercut, turning nut end and cutting off. Close tolerances are easily held.

Built in short and long lengths, up to 18-inch stock feed, and from 1 1/16-inch to 2½-inch bar stock capacity, Model B can be equipped with hopper-feed or rotary tilting magazines for secondary operations. Cutting tools can be mounted singly or in series for turning one or more diameters of various lengths. Model B has double cross slides for forming tools and overhead slide for independent cut-off.

Where shafts of multiple diameters, various types of studs, nipples, tap blanks and pins are to be produced rapidly in quantity, Model B Cleveland *Single Spindle* Automatics solve tough problems in many metal working plants throughout this country and overseas. *Small lots and short runs* are of course ideally suited to Cleveland *Single Spindle* Automatic operation.

Ask for descriptive literature giving complete information on the utility and flexibility of Model B Clevelands. •

THE CLEVELAND AUTOMATIC MACHINE COMPANY

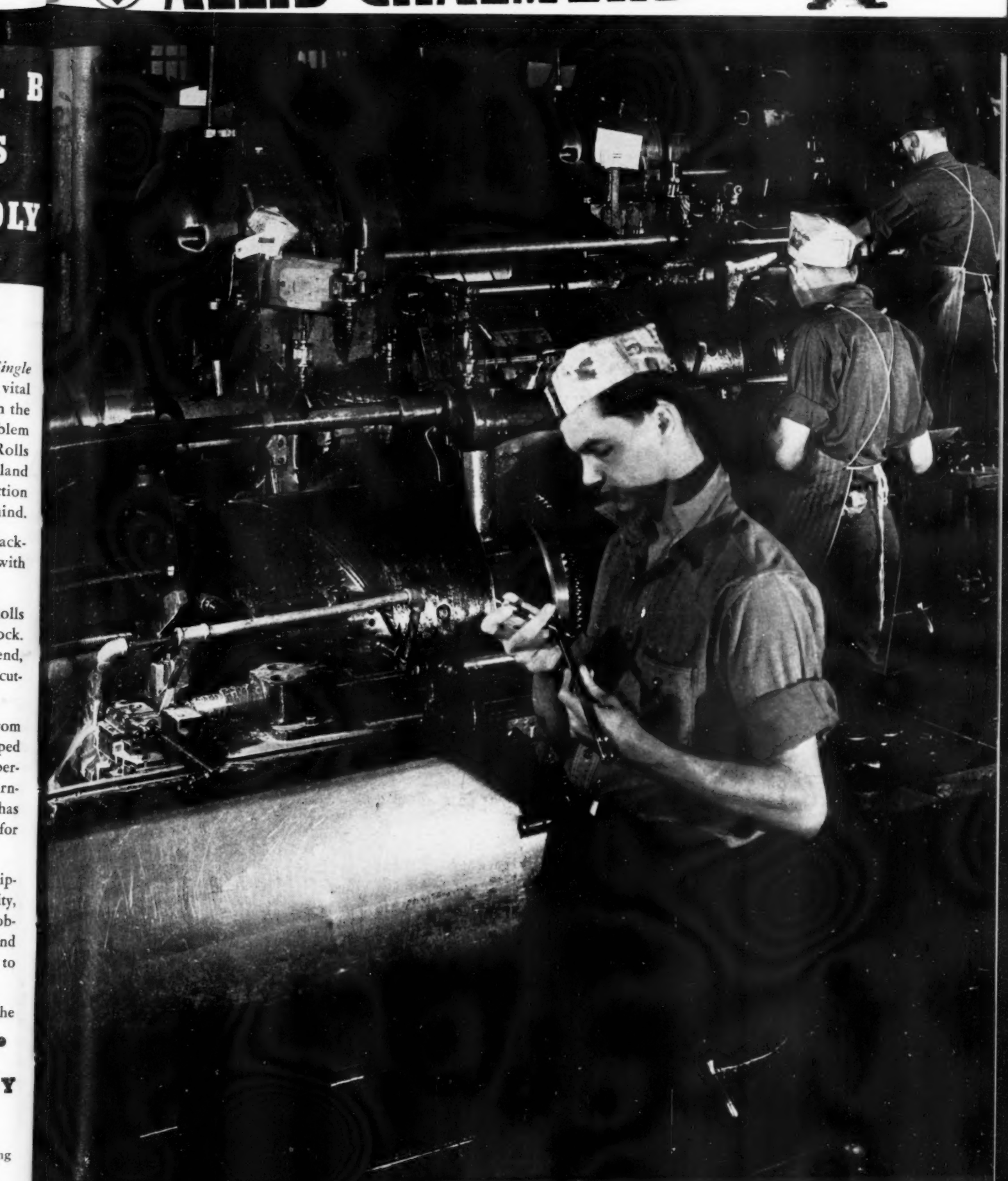
2269 ASHLAND ROAD • CLEVELAND, OHIO

Sales Offices: CHICAGO: 20 North Wacker Drive, Civic Opera Bldg., Room 1408

DETROIT: 540 New Center Building • NEWARK: 702 American Insurance Building • CINCINNATI: 507 American Building

★ ★ ★ ★ ★ ★ ★

Consider **Cleveland *Single Spindle* Automatics if you make duplicate parts in small quantities. By using *single spindle* automatics the increased production obtained from them may release a number of other critical machine tools for other purposes.**

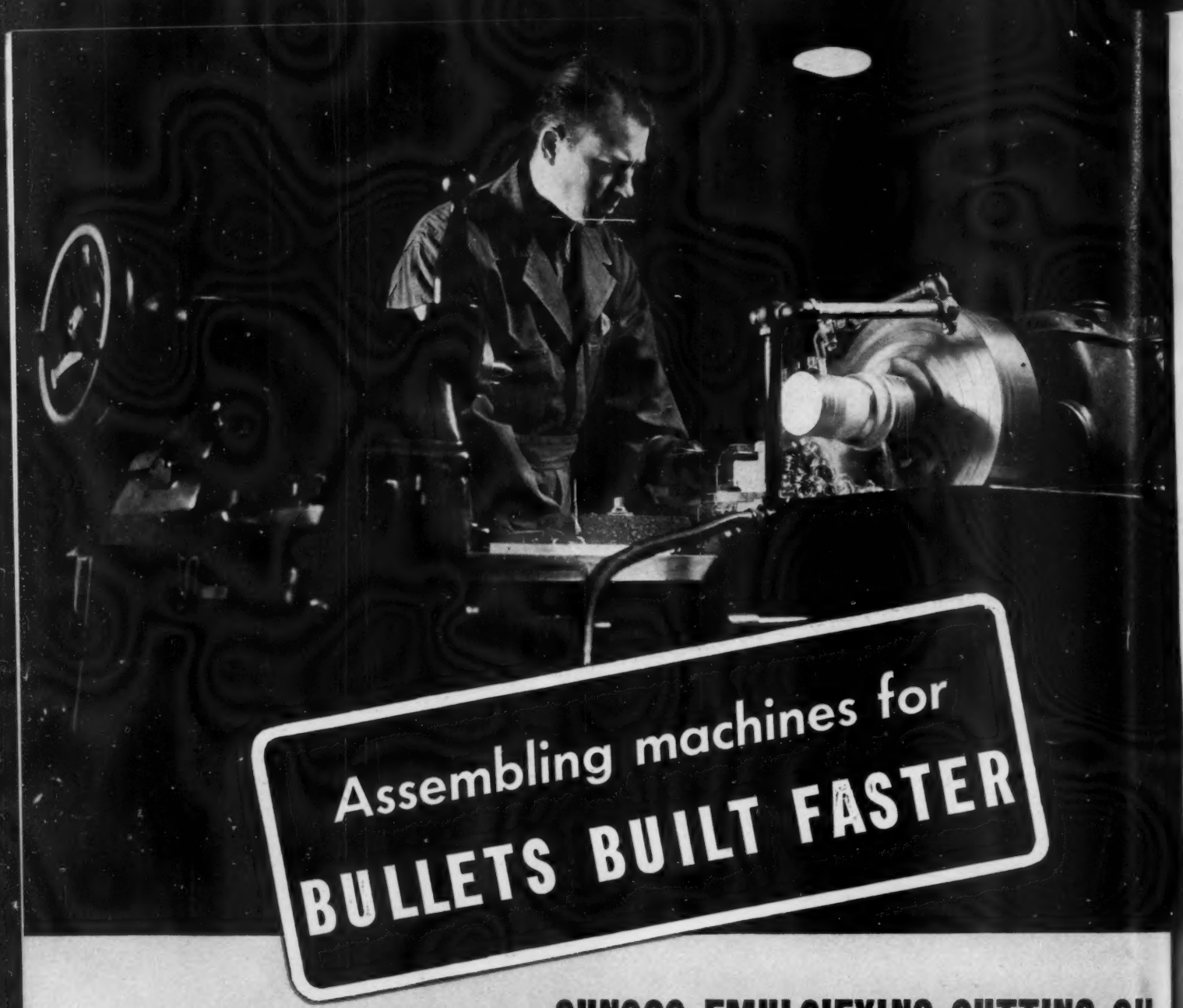


CLEVELAND *Single Spindle* AUTOMATICS

MODEL A—Built in 1 1/16-inch to 9 1/2-inch capacities inclusive

MODEL B—Built in 1 1/16-inch to 2 1/2-inch capacities inclusive

from them may release a number of other critical machine tools for other purposes.



SUNOCO EMULSIFYING CUTTING OIL

"helps machine manufacturer prolong tool life by 40%"

Bullet assembling machines are the wartime specialty of this machine tool manufacturer . . . and one factor that's contributing to their high production quota is Sunoco Emulsifying Cutting Oil.

Before changing to Sunoco, excessive heat made necessary low machine speeds. Production was limited . . . tool life poor. At the recommendation of a Sun Doctor of Industry—a metal working expert—the change in cutting oil was made. Improvement was immediate. Tool life increased 40%. Sunoco's exceptional heat absorbing qualities permitted high speeds . . . production was increased 40% and the finish of parts was noticeably better.

This is one example among many where Sunoco Emulsifying Cutting Oil is helping American industry turn out a flood of better war materials—faster. Call in a Sun Oil Company Engineer. Let him show you the value of Sunoco as an aid to increased production in your own plant. He stands ready . . . willing . . . and able to serve you.

For case histories of how he has helped others, write for your copy of "Helping Industry Help America."

SUN OIL COMPANY • ***Philadelphia***

Sun Oil Company, Ltd., Canada

SUNOCO

SUN PETROLEUM PRODUCTS

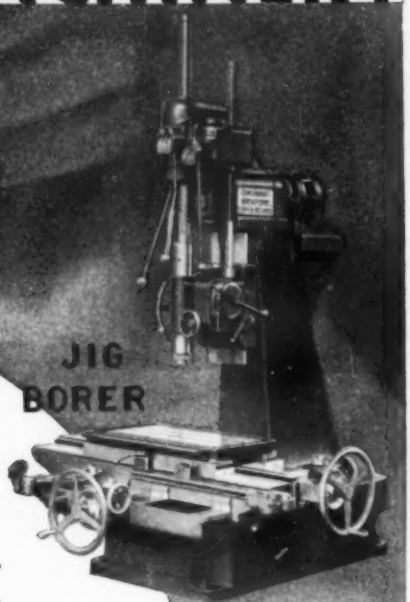
HELPING INDUSTRY HELP AMER

METAL DRILLING MACHINERY

3' or 4' ARM with 9" COL.

RADIAL
BULLETIN R-21-B

SUPER C B SERVICE



JIG BORER

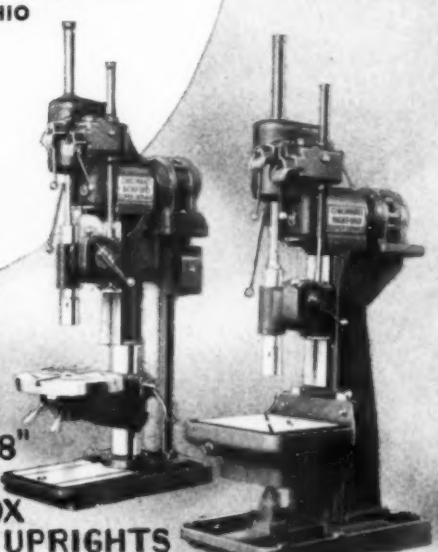
BULLETIN U-26

Productivity, Capacity, Adaptability, Reliability, Accuracy, Convenience and Economy are the intangible components that give the Cincinnati Bickford line of drills the appropriate name of SUPER SERVICE. Examine the possibilities of the machines shown here and for further information send for any or all of the bulletins pertaining to the machines that interest you.

THE CINCINNATI BICKFORD TOOL COMPANY
OAKLEY, CINCINNATI, OHIO

4' ARM 13" COL. to
8' ARM 19" COL.
RADIAL
BULLETIN R-24

ARMY E NAVY
AWARDED SEPT 10, 1942

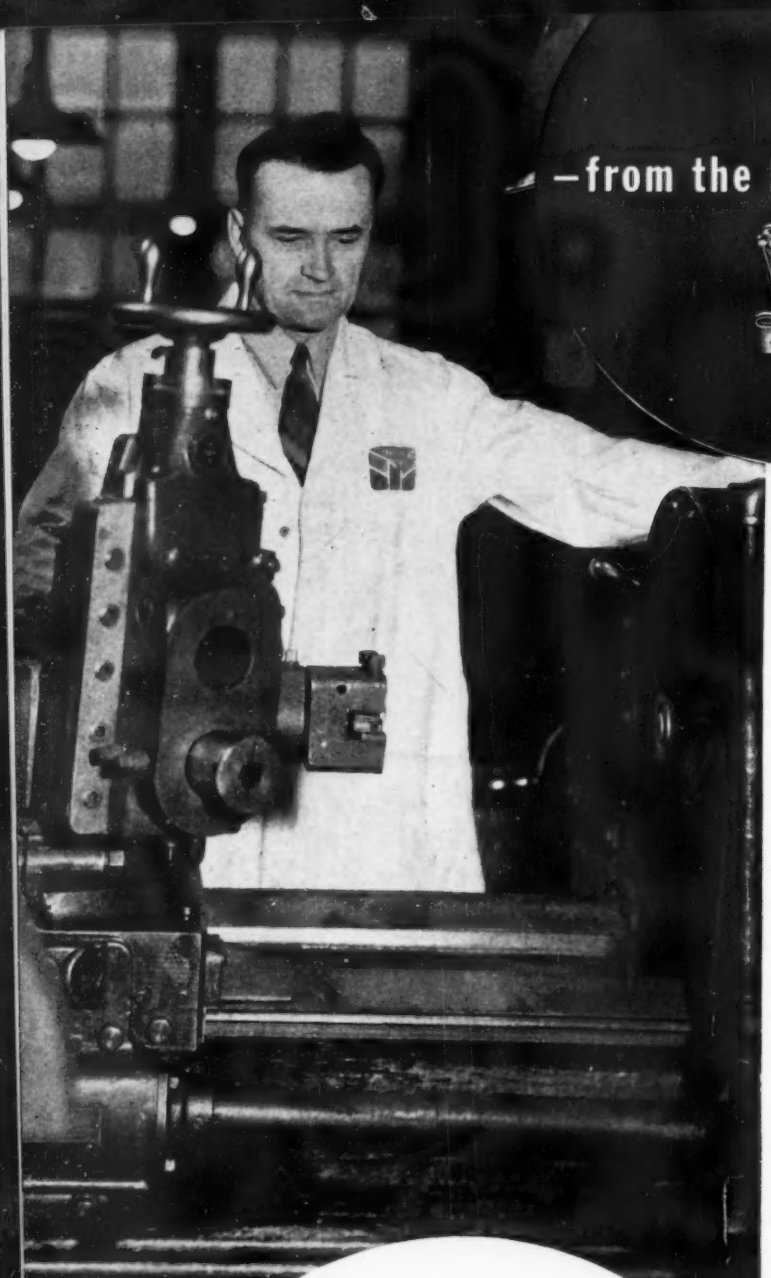


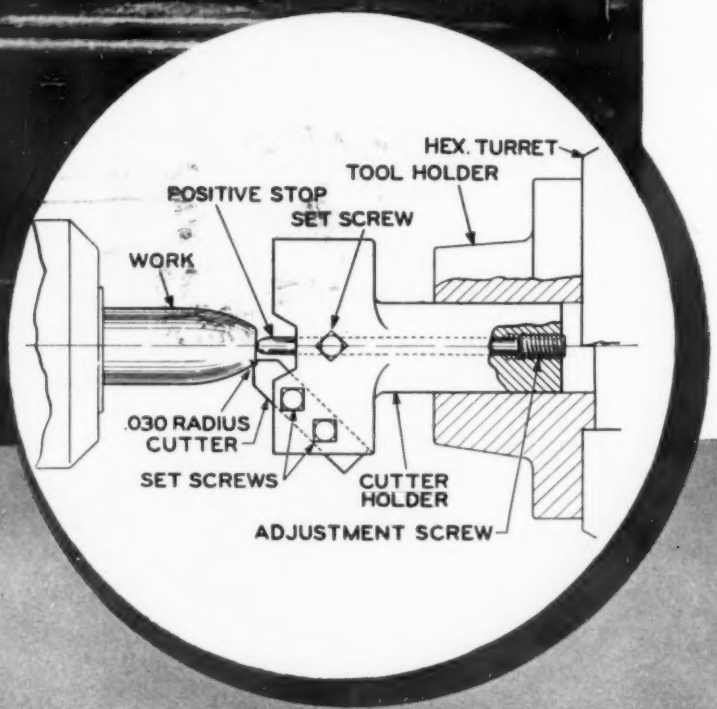
21", 24", & 28"
ROUND
and BOX
COL. UPRIGHTS
BULLETIN U-25

Ideas for VICTORY

—from the Production Lines behind the Firing Li

A Citation for Men in War Industry





HIS METHOD STEPPED UP PRODUCTION OF 20 MM. SHELLS

MANY machine tool operators deserve a lot of credit for applying individual ingenuity and resourcefulness to speed war production.

Such an operator is Chas. F. Marshall, setup man at the Oliver Farm Equipment Co., South Bend, Ind.

Operator Marshall developed a tool for machining a .030″ radius on 20 mm. shells (see sketch). Because a stop is built right into the tool and locates from a finished face on the work piece, no particular care need be taken in loading work of slightly varying lengths into the spindle. Time was saved, accuracy improved, and production increased about 20%.

In addition to the Victory Pin, presented by Warner & Swasey, Mr. Marshall has been rewarded with a war bond by his company.

Many turret lathe operators have written us, telling how they have used the machines and tools at hand to best advantage. Many of these ideas are passed along in Blue Chips, a shop bulletin now being mailed free to the homes of over 38,000 turret lathe operators. Are your operators on this mailing list? Write Warner & Swasey, Cleveland, Ohio.

WARNER & SWASEY FOR VICTORY

YOU CAN TURN IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

WHAT'S IN THIS ISSUE

FREDERICK V. GEIER

DAVID H. SAMUELSON

ARTHUR K. KORN

CONSERVE MANPOWER

The growing loss of manpower in war industries by accidents on and off the job must be curbed. Since Pearl Harbor 17,100 workers have been killed or injured. The resulting 500,000,000 man-days lost would have produced much critical equipment needed by our armed forces. Such inexcusable waste can be reduced by foolproofing machinery and educating workers. Efforts toward this end as advocated by the National Safety Council are presented by Frederick V. Geier, president, Cincinnati Milling Machines and Grinders, Inc. Page 71.

TOPS IN SHELL FORGING

When a plant can forge thousands of 75- and 90-mm. shell bodies daily with less than 0.5 percent rejections, and then reclaims many of the rejects, its practices warrant study. Details are given in the Armament Section. You will find drawings of punches and dies for hydraulic piercing and drawing presses, as well as diagrams of hydraulic circuits for semi-automatic operation. Inspection of hot forgings and adjustable dies make corrections possible as soon as an imperfect shell body is discovered. Page 93.

PRODUCTION UP 300 PERCENT

Lathe spindles have counterparts in many types of machinery. That is why an article by David H. Samuelson, lubrication engineer, Warner & Swasey Company, is presented to give good practices in drilling and reaming them. The work is done in heavy-duty turret lathes. The rigidity of the set-up, making it possible to withstand the high end pressure of the drill, permits the use of fast speeds and feeds. Production was increased threefold. Page 74.

SPEEDS LAYOUT

Exacting layout of small castings requires time—valuable time that can hardly be spared these days. Therefore, any device to speed such layout should be welcome. A special table equipped with scales and mechanism that adjusts the height of the working surface is described by Henry Aschenbach and Donald Rae, Package Machinery Co. Page 85.

IDEAS FOR VICTORY

We continue the publication of suggestions considered meritorious by the Board of Awards, War Production Drive. These shop ideas, selected because they have increased production in the designer's shop, are worth studying. If they cannot be used directly in other shops, they often give birth to ideas that speed war material to our armed forces. Page 86.

IMPROVES GRINDING TECHNIQUE

When grinding the external wall of a thin cylinder, coolant streams directed against the inside wall, as well as at the grinding wheel, dissipates a maximum of heat and results in a better finish. That is the function of the arbor and hollow centers described in the Armament Section. Page 107.

HOW TO CHOOSE REAMERS

Reaming of holes is too often considered matter-of-fact practice. But it is the wise man who realizes that reamers when properly selected, ground and driven produce top results over long periods. What are the best flute chamfers and tapers when reaming is done by machine? What are the best methods for holding reamers in drill presses, turret lathes and screw machines? What is the best practice in line reaming? These are but a few of the questions answered by Arthur H. Korn in his article on the choice and use of these tools. Page 76.

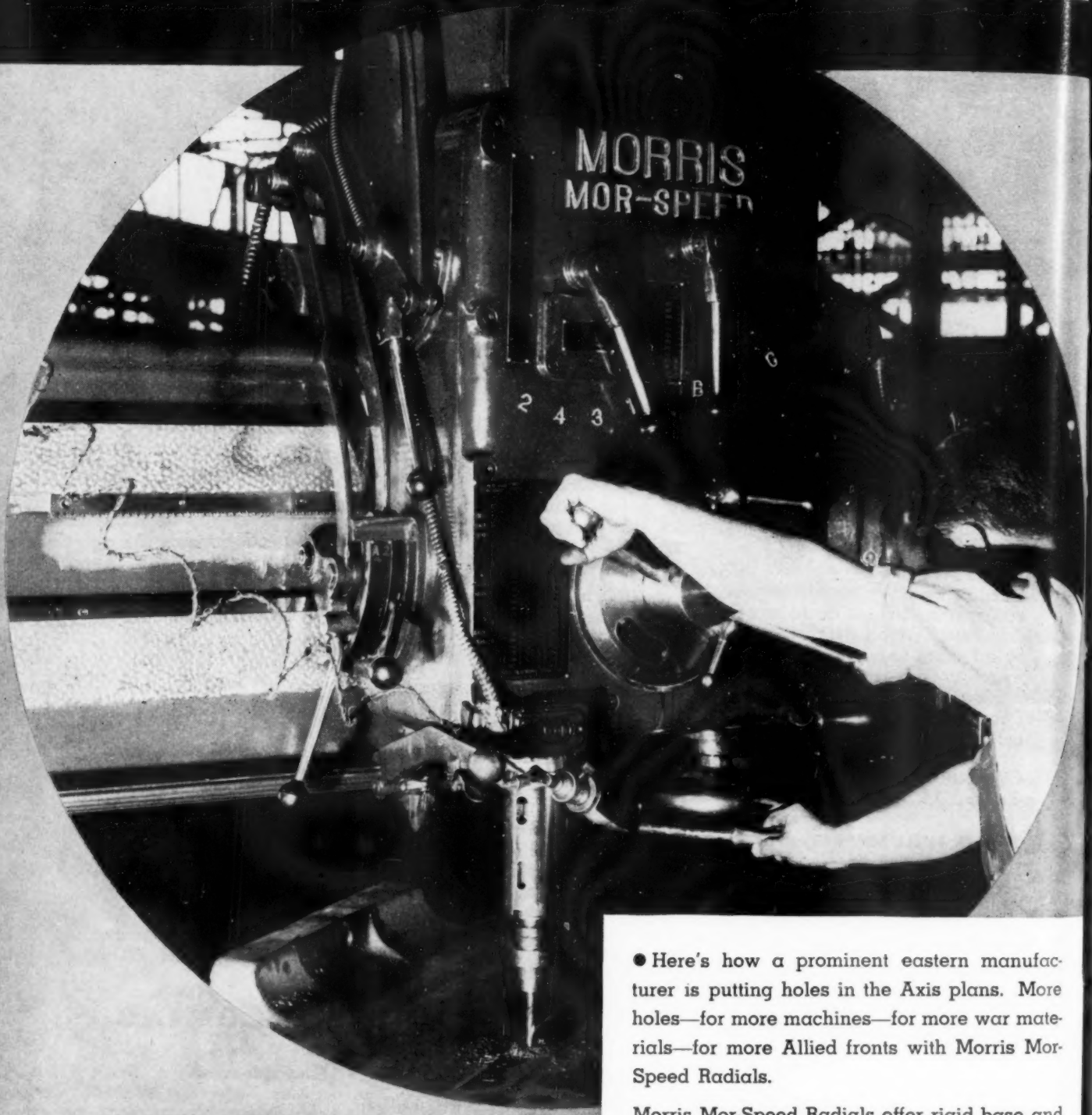
BEST ALUMINUM ELECTRODES

With welding gaining ever-greater prominence for the lightness and strength of parts it produces for our fighting machines, an article on spot welding aluminum and its alloys is particularly timely. Choice of properly shaped electrodes and maintenance of such shapes are discussed. The making of check samples is described, along with a wealth of other data. Page 82.

COMING

The next issue, out January 21, is our Annual Buyer's Reference Number. New machines, equipment, materials, small tools, and processes that were described in the pages of AMERICAN MACHINIST during 1942 will be summarized by illustrations and captions. This issue will also include the Buyers' Guide. Here you will find for ready reference a compilation of suppliers of machines, accessories and materials that is of help in locating companies that can supply your needs. You will want to keep this issue on your desk throughout the year.

MORRIS MOR-SPEED RADIAL



● Here's how a prominent eastern manufacturer is putting holes in the Axis plans. More holes—for more machines—for more war materials—for more Allied fronts with Morris Mor-Speed Radials.

Morris Mor-Speed Radials offer rigid base and column construction—balanced head and arm design—all power driven parts running in oil—smoother power—centralized control—and ample speeds and feeds for all jobs.

Put your Radial work on a Morris Mor-Speed not alone for greater production and closer accuracy but for lower costs as well.

●PRATT & WHITNEY
exclusive Sales Agents
for the United States

Builders of MOR-SPEED Radials

The MORRIS Machine Tool C

The accident rate in America is a major handicap in winning the war. Since Pearl Harbor, 17,100 workers have been killed or injured on and off the job, resulting in 3,000,000,000 man-hours lost—man-hours that could have produced hundreds of individual items for our armed forces. Here are other breath-taking facts: More Americans have been permanently disabled by accidents off the job since Pearl Harbor than the total of men in the armed forces captured, wounded and killed in action to date. We lost more civilians in accidents last year than England lost in the first two years of war fighting on a dozen fronts. This inexcusable waste can only be reduced by foolproofing machinery and educating workers

—Editor

SAFETY IS A WEAPON

BY FREDERICK V. GEIER, PRESIDENT, THE CINCINNATI MILLING MACHINE COMPANY

THE MACHINERY INDUSTRY is at the foundation of the massive structure of America's war effort. The makers of machines—because of their skill and their national responsibility—are in the van of our industrial army.

In spite of all that has been accomplished in subdividing operations and training new workers, there remain important areas in which there is very limited scope for improvisation in the matter of skills. This is true in many phases of machine tool building. Time, patience and long experience remain vital factors in doing the industry's job of production engineering and service for America's war production industries. In view of the limited supply of qualified American manpower, the necessity of safeguarding the machinery industry from losses through accidental death or injury of its workers cannot be overemphasized.

Machine builders have a vital role in the National Safety Movement. Every effort must be made to stop accidents that are cutting down our manpower

★ ★ ★

In the machinery industry a good man not only has to be born—he has to be made as well. If he wastes his experience through becoming the victim of an accident, wherever the blame may lie, it adds up to a failure in the line of duty.

The machinery industry in consequence has a vital interest in the accident-prevention movement now sweeping the country under the leadership of the National Safety Council and its War Production Fund to Conserve Manpower. A web of safety controls covering the entire United States, centrally directed by an organization with a national perspective, is indispensable in preserving the dwindling pool of manpower.

This safety movement dates back before Pearl Harbor. Serious concern among businessmen and industrialists over the growing menace of accidents culminated in a Presidential proclamation warning of the gravity of the situation, and calling on the National Safety Council to plan a counter-attack. The Safety Council, an organization with thirty years experience in dealing with the hydra of accident, was a logical choice acceptable on all sides.

To cope with a trend that in the year of Pearl Harbor resulted—including all kinds of accidental death and injury

on and off the job—in 102,500 deaths, 9,300,000 injuries of all description and 480,000,000 man-days lost, the Safety Council had to expand in many directions. To finance this expansion there was set up the War Production Fund, with a goal of $5,000,000 to be raised by voluntary contribution from business and industry.

William A. Irvin, former president of the U. S. Steel Corporation and a pioneer in industrial safety, is now devoting his full time to the national chairmanship of the War Production Fund. Thomas W. Lamont, treasurer of J. P. Morgan and Company, is the fund's national treasurer. The fund is currently engaged in a national campaign covering every major industrial center in the United States.

Accident Total is Staggering

From Pearl Harbor through the end of November, 1942, the staggering total of 46,300 accidental deaths affecting industry has been recorded. This figure excludes accidental deaths to non-workers—e.g., to wives and children at home—which is a powerful negative factor in morale. Count these in and the total rises to 93,000 Americans dead by accident since Pearl Harbor. Permanent disabilities for workers alone run over 160,000, and all injuries to workers—including the permanent—are calculated at 4,000,000.

Of more importance in getting a broad view of what accidents mean to our production schedules is the trend in frequency of occurrence. The last complete analysis covers the year 1941, which shows a rise of eight percent for all industry after a decade and a half of steady decline. The severity rate for 1941, however, showed a decline of eight percent as compared with the previous year.

Within the whole industrial mosaic, the manufacture of machinery enjoys a general accident experience considerably better than average. In 1941 frequency rates averaged 10.66 reportable injuries per million hours worked, or about two-thirds the average of 15.39 for all industry. Even better was the industry's severity rate of 0.79 days off per thousand hours worked, against an average of 1.53 for all industry.

With respect to *trend*, as distinguished from absolute totals, the accident experience of the machinery industry does not stand up so well. The frequency rate in 1941 showed a *rise of seventeen percent* over the previous year, as against eight percent for all industry. The severity rate shows a *rise* of seven percent, as against an eight percent *decline* generally recorded.

These last figures are deserving of critical attention. The machinery industry, after all, operates according to its own techniques and tradition. Its relative position with respect to all other industries is of statistical importance, but its own specific accident experience must be the basis for preventive action.

The accompanying table shows a breakdown by type of manufacture of the industry's recent accident experience. It is safe to say that on the whole the trends it reveals have continued throughout this year, since the already great pressures on management have increased and the speed-up in accident prevention is just beginning to take hold.

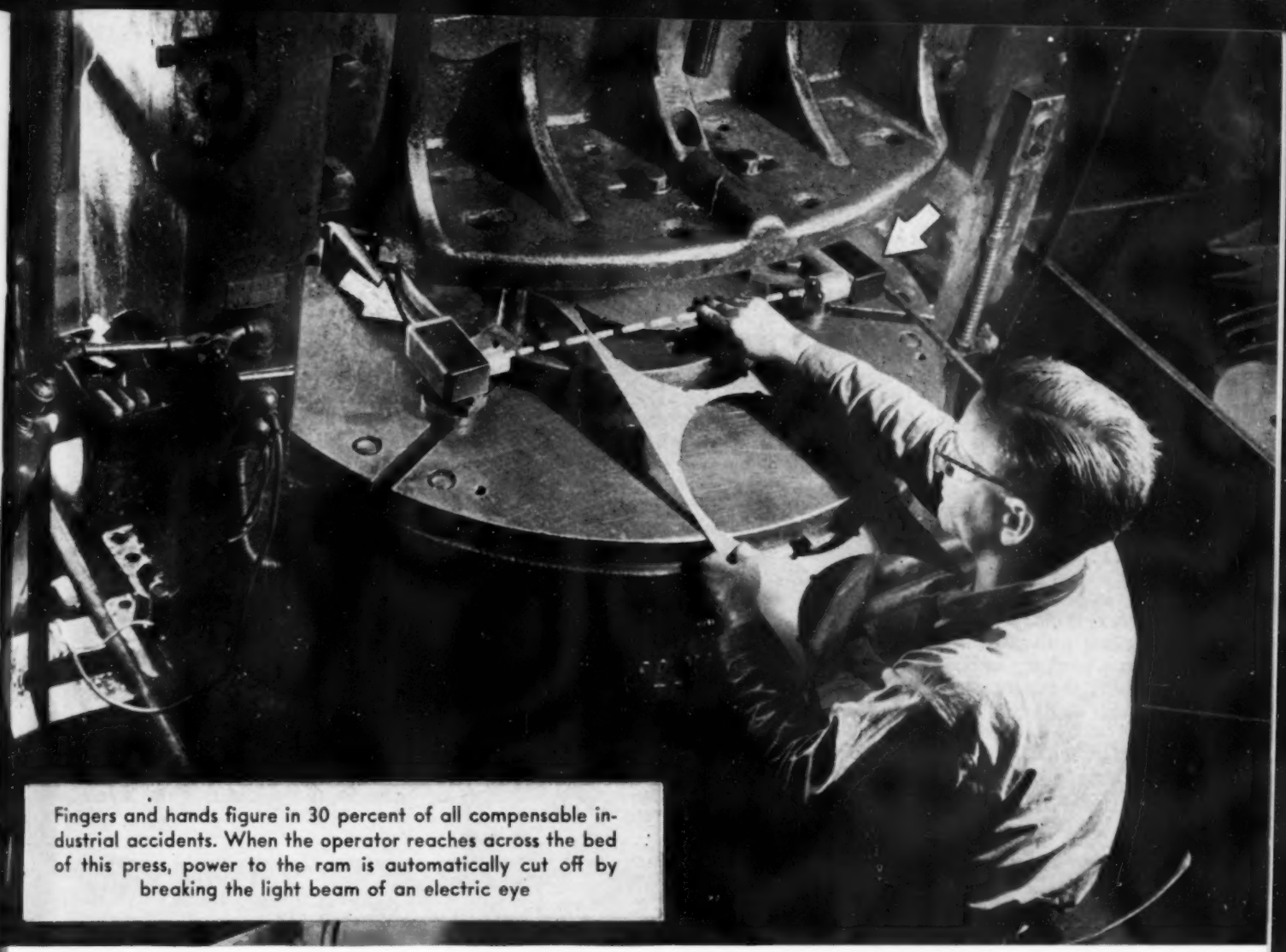
Injuries on the Job

In more than half the injuries in the machinery industry listed in the table, the worker became entangled in moving parts. One-fourth of serious machinery accidents happen on the presses, while on grinders, lathes, drill presses, milling machines and power saws accidents occur often enough to indicate clearly insufficient attention to good safety practice. In the remaining half, accidents involving elevators and hoisting apparatus take the lead.

In 90 percent of all accidents, estimates show that the employee's carelessness is a contributing factor. At the same time in a majority of cases unsafe

RATES AND SEVERITY OF INJURIES BY INDUSTRIAL GROUPS

Industrial group	No. of units	Frequency rate: 1941 rate	Frequency rate: 1940–41 change	Severity rate: 1941 rate	Severity rate: 1940–41 change	Ratio of lost time due to injuries 1937–41, causing: Death	Ratio of lost time due to injuries 1937–41, causing: Permanent partial disability	Average time charge per case, 1937–41: Permanent partial disability	Average time charge per case, 1937–41: Temporary total disability
All industry	314	10.68	+17%	0.79	+7%	1 in 238	1 in 11	388	19
Fine machinery and instruments	45	5.48	+86%	0.29	−20%	1 in 483	1 in 11	377	17
Light electrical applicances and machinery	39	5.48	+15%	0.39	+29%	1 in 243	1 in 10	430	21
Heavy electrical appliances and machinery	21	6.55	+17%	0.63	+11%	1 in 172	1 in 13	535	26
Railroad car	27	8.19	+4%	2.11	+45%	1 in 56	1 in 11	622	29
Engines, pumps, compressors, and similar equipment	14	11.92	+29%	0.62	−32%	1 in 567	1 in 10	399	20
Machine tools	22	15.50	+11%	0.67	−12%	1 in 386	1 in 16	326	18
Special machinery and implements	35	16.98	+72%	0.79	−13%	1 in 185	1 in 15	380	15
Agricultural machinery	35	21.87	+23%	1.05	+1%	1 in 668	1 in 8	264	15
Construction, conveying and similar equipment	26	24.80	+40%	2.43	+18%	1 in 161	1 in 9	450	17
Not otherwise classified	50	10.64	+17%	0.75	+8%	1 in 315	1 in 15	433	17



Fingers and hands figure in 30 percent of all compensable industrial accidents. When the operator reaches across the bed of this press, power to the ram is automatically cut off by breaking the light beam of an electric eye

conditions must also be considered a factor. A faulty relationship between operator and machine is the most prolific source of trouble. In a typical accident the operator reaches under the ram of a punch press to pry out a jammed piece of work. He trips the press and loses several fingers before he has time to cry out. Obviously the man is at fault. At the same time there is no excuse for allowing the machine to be unguarded against inevitable departures from safe practice.

Educate the Worker

With more care than ever before, fundamental safety factors should be incorporated in the physical layout of the shop. Individual machines should be well lighted, the aisles wide enough to permit orderly traffic. Machines should be driven directly, wherever expedient, though any method of power application presents little hazard if wisely engineered. Machines should have individual controls. Safety should be built into the machine—and into the mind of the operator.

Great care should be exercised in keeping the shop floor free of litter and oil. In installing metal-working machinery on upper floors close attention should be given to stresses and strains. Workers should avoid loose fitting clothes, and long sleeves which can get caught in moving parts. They should be encouraged to keep their arms and hands washed free of cutting oils in order to avoid infections. Only experienced men should undertake the job of rebabbitting bearings. Women operators should wear caps, one-piece overalls or equivalent uniforms.

There is no question that machinery industry employees will stem their currently increasing accident experience only provided they are consistently drilled in the dangers of carelessness. Men with less than one year of service accounted for fully one-third of all accidents in 1941. Analyses show that even the practices of newly employed skilled workers must be closely watched.

The careless worker is ingenious in finding ways to hurt himself. He works on moving machinery instead of stopping it, and prefers using fingers to tools. He lifts heavy pieces with his back bent. He races up ladders without a thought about the slope of the ladder or whether its feet are securely anchored, and thinks it is only Milquetoasts who wear goggles, safety shoes and hard hats. He is prone to carrying on conversations under hoists bearing a five-ton load.

Supervision Needed

The answer to this inertia with respect to the danger of accident is, of course, never-ending supervision and safety education. It is important that the worker understands it is no longer a simple question of his and the company's interest to preserve his life and limb. If he makes a slip in these times, he is committing a minor act of treason. He simply has no right to hurt himself when millions of young men are depending on him to deliver the goods.

Management must take the lead and energize the whole program of safety and the conservation of manpower. This task is a challenge to industrial leadership and to patriotic purpose in the nation's war effort. *Safety is a weapon* that will help us win.

Spindles Drilled Faster

BY DAVID H. SAMUELSON, LUBRICATION ENGINEER, WARNER & SWASEY COMPANY

Need for increased production and more floor space led to the use of turret lathes for boring lathe spindles. As a result, production rate was multiplied

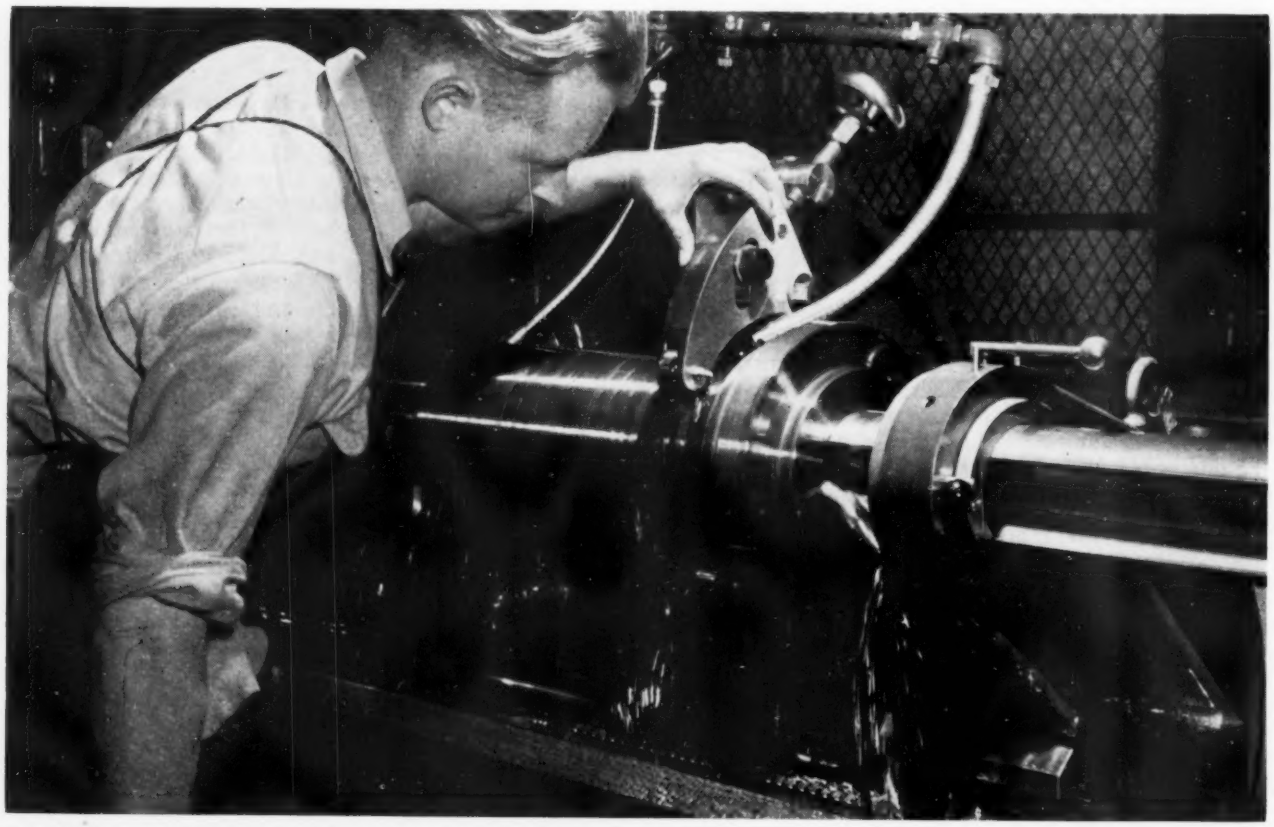
BY TOOLING UP a heavy-duty turret lathe for the drilling and reaming of lathe spindles, the production rate for this operation has been increased 300 percent at the Warner & Swasey plant. Because of the increased rigidity with which the work could be held, the power available with a turret lathe, and the lathe's ability to withstand the high end pressure of the drill, it was possible to step up the feeds and speeds.

The material used in the spindle is SAE 1050 or SAE 4140 forged steel on which the Brinell hardness averages between 200 and 225. The bored holes vary in size from $2\frac{7}{32}$ to $4\frac{3}{4}$ in. in diameter, while the spindle lengths vary from 27 to 40 in. Tools now are being made to handle still larger spindles by the same method.

Several ways of holding the spindles were considered. The method finally selected was to grip the spindle on the small end in a three-jaw universal geared scroll chuck and support the large end or nose with a steadyrest. The spindles are rough turned before delivery to this lathe for drilling and reaming.

The boring of the hole from the solid forging is done with a flat drill cutter mounted in an oil drill bar. This bar is mounted in the hexagon turret of the lathe and is piloted by a bushing located in a support attachment. After the hole has been bored, an adjustable shell reamer mounted on an oil hole reamer bar is fed through the hole for final sizing and finishing. Feed used for the flat drill is 0.008 in. per rev. with a cutting speed of about 55 ft. per min. The flat drill cutters are sharpened after each piece, up to 0.005 in. being ground off each cutting edge. This regular sharpening of the cutters keeps them in top condition. Both tungsten and molybdenum high-speed steel flat drills have been found satisfactory on this job.

The shell reamer is fed into the work at a rate of 0.50 in. per rev. while the work is being rotated at a sufficient speed to give about 40 ft. per min. cutting speed. These reamers are sharpened after about every ten pieces. The amount of stock left in the hole for



For drilling and reaming spindles in turret lathes, Warner & Swasey grips the spindle on the small end in a three-jaw chuck and supports the large nose end with a steadyrest. A copious supply of coolant is fed under pressure to the cutting edges of the flat drill bit to carry away the chips which are broken into small sections

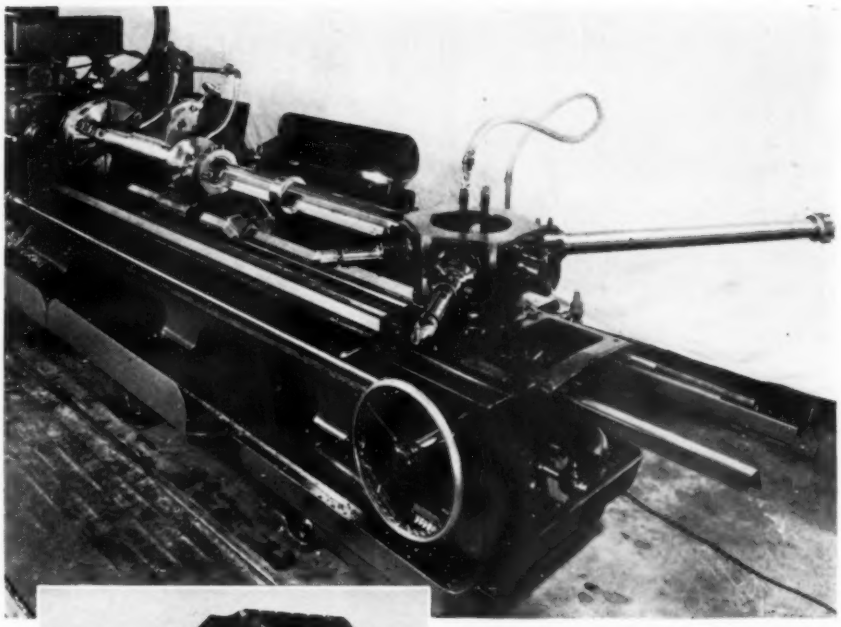
reaming is 0.020 in., on the diameter, or 0.010 in. in depth of cut. Two hours are required to bore and ream an average sized spindle.

Oil Is Flooded on Work

Approximately 45 gal. of oil per min. are supplied through the bars to the cutting edges at a pressure of about 250 lb. per sq. in. The temperature of the cutting oil averages about 110 F. Two extra streams of oil cool the outside of the piece as the drilling progresses. This helps in conducting heat away from the work. The cutting oil used contains a high percentage of saponifiable matter and sulphur, and has been given an extreme pressure treatment. The Saybolt universal viscosity is 140 sec. at 100 F.

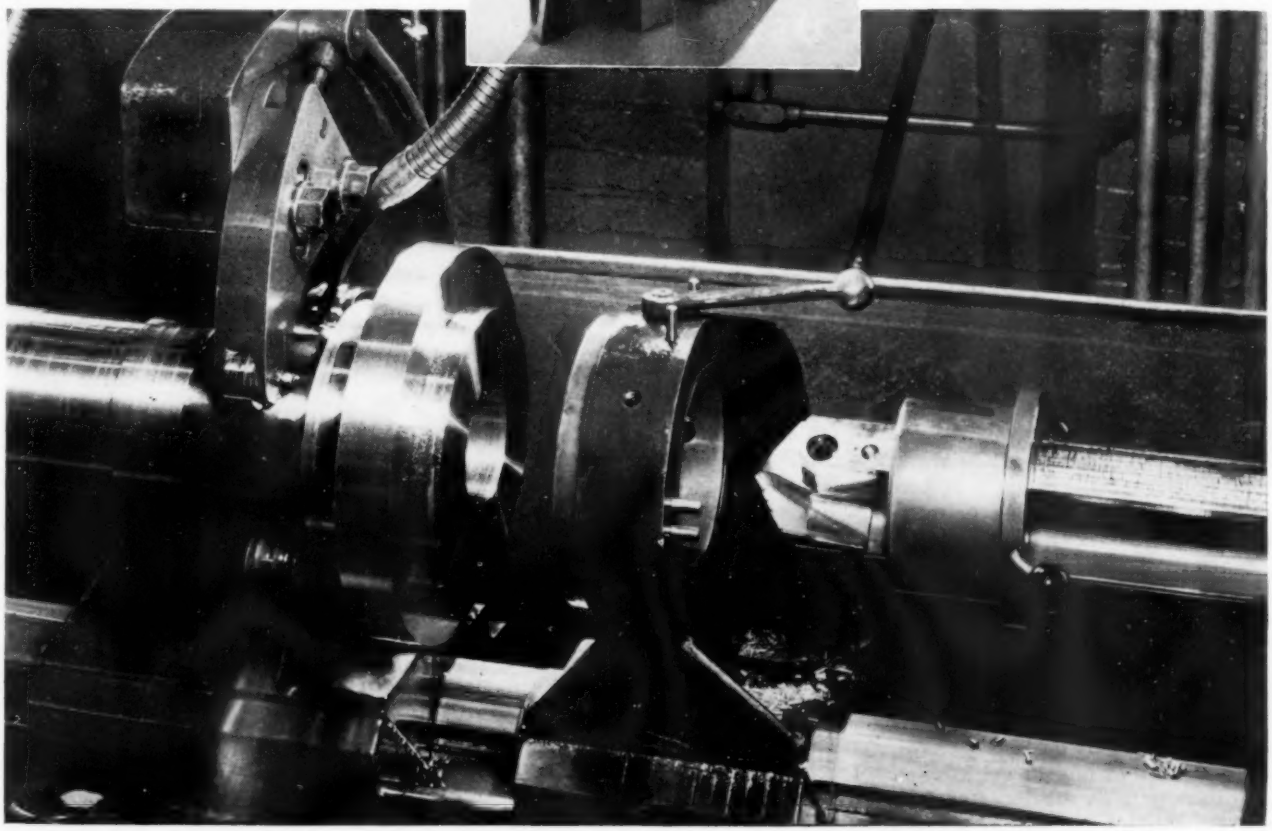
A flexible hose which feeds the cutting oil from the pump to the hexagon turret may be quickly connected to ether of two pipes. One pipe supplies oil to the drill bar and the other to the reamer bar. Two small copper tubes on each of the bars direct the oil to the cutting edges of the tools.

As a result of a careful time study of the spindle drilling and reaming operation, it has been found practical to assign one man to handle three turret lathes doing this work.

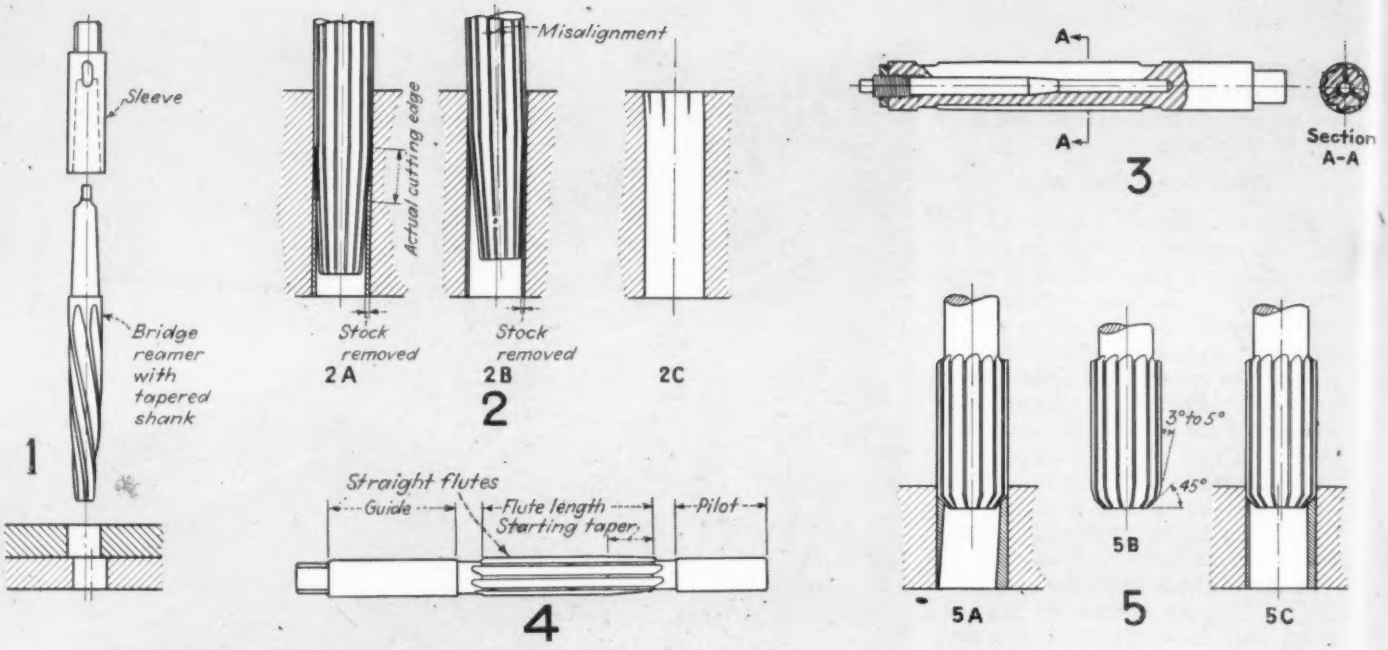


The lathe has an extra long bed to hold the work outside of the spindle and to permit using long oil drill bars for the flat drill cutter and adjustable shell reamer

Chip breaker slots staggered on each cutting edge of the flat drill cutters break chips



The oil drill bar carrying the cutter is mounted in the hexagon turret and is piloted by a bushing located in a pilot support attachment. Pins on the attachment contact handles on the bushing to keep it from rotating



REAMERS

How to choose them and how to use them

BY ARTHUR H. KORN,

HOLES PRODUCED by drilling usually are not very accurate. A precise diameter cannot be maintained because the drill itself varies within considerable limits. Moreover, it is slightly back-tapered so that a short—broken and reground—drill cuts smaller holes than a new one of full length. The size of the holes also depends on whether the point of the drill is ground symmetrical or slightly eccentric. Another, and as a rule far greater inaccuracy, is that of the drilled hole not being straight or perpendicular to the drilled surface. Moreover, drilling does not produce a smooth surface. Deep scratches in the drilled hole are common. All of these inaccuracies and surface irregularities can be reduced greatly by reaming.

One of the first machine shop experiences the writer had as a boy was the difficulty of getting a bolt through flange holes that were out of alignment. The foreman told him to get a set of hand reamers from the tool crib and run them through the holes. But the reamers could not be entered because the holes overlapped too much. The reamers of the next smaller set fell through the holes without doing any reaming. A round file had to be used because the hand reamers had failed.

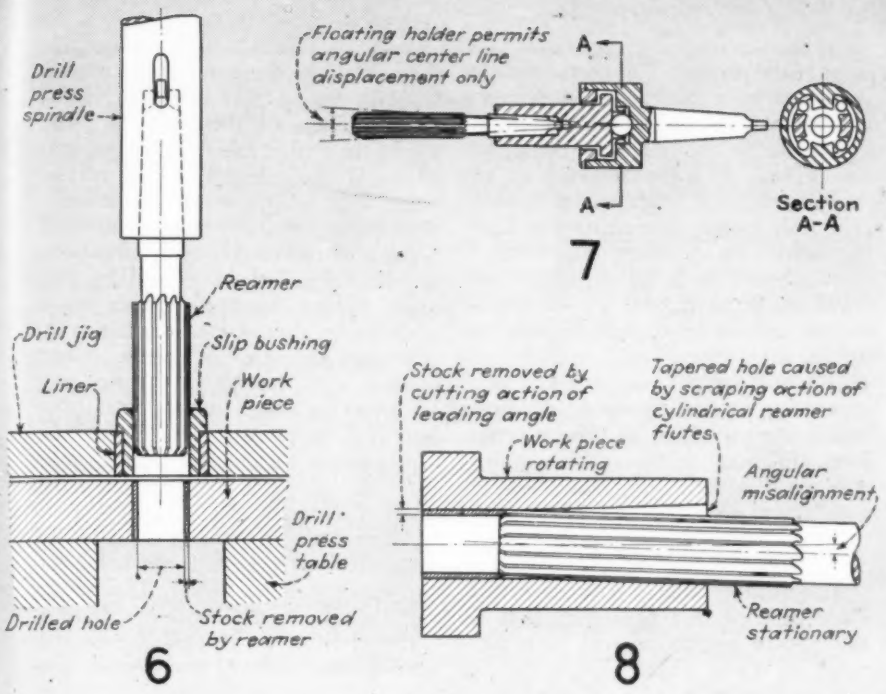
The hand reamer was never meant for that kind of a job. It is too expensive and too easily dulled, chipped and worn down unevenly by rough work of that sort. The right tool to use in such a case is the bridge or car reamer shown in Fig. 1. It is sufficiently tapered so that it can enter holes which overlap considerably. The bridge reamer is made with a tapered shank for use in a machine, with a squared straight shank for hand reaming, and with a tapered square shank for use with a ratchet. Instead of having two identical reamers with different shanks, it is economical to use a sleeve, as shown in Fig. 1, to adapt a bridge reamer with a tapered shank for hand reaming.

The commercial hand reamer has a taper angle of from 15 to 30 min., the tapered length being about one-fourth of the fluted length. The cutting action of one of these reamers is shown at *A* in Fig. 2. Due to the small taper it can remove but a few thousandths of an inch of stock. It is difficult, if not impossible, to align it properly with the hole, as shown at *B* in Fig. 2. For this reason it cannot produce an accurate cylindrical hole. While it is being jiggled into alignment, the flutes may cut deep furrows in the hole as shown at *C* in Fig. 2. If the hole is very long, the reamer will eventually straighten itself into alignment with the hole as it is fed deeper. The cylindrical part of the flutes will then act as a guide.

Use of Hand Reamer Limited

The motion of a hand reamer is complex. It seeks alignment with the hole while its centerline tumbles about the centerline of the hole. The usefulness of the commercial hand reamer is, therefore, limited to work where only a few thousandths of an inch of stock must be removed, and where, at the same time, no great cylindrical accuracy and fine surface finish is required. It is used extensively in repair work, and can be used to ream holes in machine frames which are too heavy to be moved conveniently for machine reaming. Under no circumstances should bearings be reamed with a commercial hand reamer.

Considering the small amount of material a hand reamer removes, its wear is prodigious. This is caused by the very long cutting edge or width of chip. The wear on a new reamer can some-



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Stock removed by cutting action of leading angle
Tapered hole caused by scraping action of cylindrical reamer flutes
Work piece rotating
Angular misalignment
Reamer stationary

8

1. Bridge-type reamers are tapered so they can enter holes which overlap considerably

2. Commercial hand reamers usually have flutes that are tapered for about one-quarter of their length

3. Expansion reamers are designed primarily to compensate for wear, not to produce holes of different sizes

4. When made with a pilot and guide section at either end of the flutes, the hand reamer can be more accurately aligned with the hole

5. Machine reamers usually have flutes that are chamfered. Holes of smoother finish may be obtained with a double chamfer like that shown at *B*. Machine reamers cut at the chamfered portion of the flutes

6. Holes can be more accurately drilled and reamed when the tools are guided by bushings in jig plates. The drill should be entered through a hardened and ground slip bushing, then this bushing should be replaced by another to guide the reamer

7. Floating holders permit reamers to center themselves with the existing hole which is to be reamed

8. When the work rotates instead of the reamer, the point of the reamer follows the existing bore. In the case of misalignment a tapered, oversize hole will result

CHIEF ENGINEER, HOLLY PNEUMATIC SYSTEMS

times be measured by the difference in size of the first two or three holes it produces. If close tolerances must be maintained, it is best to rough ream with a solid reamer and finish the hole with an expansion reamer like that shown in Fig. 3. The cutting action of an expansion reamer is similar to that of the solid hand reamer. Expansion is provided primarily to compensate for wear, and not to produce holes of different sizes.

The expansion reamer, like its sturdier but short-lived brother—the solid hand reamer, suffers a handicap in that it cannot be aligned satisfactorily with the hole. Still worse, the expansion reamer becomes more and more barrel shaped in the cylindrical part of the flutes as the reamer is expanded. Hand reamers provided with pilots and guides as shown in Fig. 4 are more easily aligned in a hole than are the more common types.

Most reaming is done by machine. The fluted part of machine reamers is very nearly cylindrical. Instead of the long starting taper of the hand reamer, machine reamers have a chamfer of about 45 deg. at the end of the flutes. Back of this chamfer, the flutes taper back toward the shank by about 0.001 to 0.002 in. on the diameter per inch of length. As shown at *A* in Fig. 5, the cutting action of a machine reamer is entirely different from that of the hand reamer. Cutting is done by the chamfer as the reamer enters the hole. Because of the elasticity of the material being reamed, a short portion of the nearly cylindrical flutes will do some scraping and burnishing, while the rest of the fluted section is more or less useless. Since the cutting edge, or width of chip, is so much shorter than with a hand reamer, the machine reamer can remove more stock.

Stock Allowance for Reaming

On bored holes it is best not to allow more than 0.012 in. on the diameter for reaming, regardless of diameter. On drilled holes it is usually necessary to allow up to $\frac{1}{64}$ in. for reaming, for the reason that standard drill sizes above $\frac{1}{2}$-in. diameter come in increments of $\frac{1}{64}$ in. Large drilled holes can be so rough and inaccurate that even the $\frac{1}{64}$-in. allowance for reaming sometimes is not sufficient to produce a flawless hole.

A hole with a smoother finish may be obtained by providing the machine reamer with a second leading angle of about 3 to 5 deg., depending on the kind of material to be reamed. The second lead, shown at *B* in Fig. 5, will prevent tear marks when heavy feeds are used. A machine reamer usually will cut a hole greater than its own size, the excess being in direct proportion to the stock removed, but will produce a hole closer to its own size when given a second lead.

Usually when reaming in an ordinary drill press, the method used for centering the work under the reamer is to allow the work piece to move freely on the drill press table. Thus, the lateral force exerted by the drill or reamer on a misaligned hole will force the work piece into alignment. As long as the work piece is comparatively light, so that the friction between the piece and the table that must be overcome in centering is not very great, and if the reamer is running fairly concentric in the chuck or taper sleeve of the machine spindle, holes can be reamed within fairly close tolerances on an ordinary drill press without any centralizing device. However, if these requisites are not fulfilled, bell-mouthed holes may result.

If the work piece is heavy the reamer may not be able to force it into align-

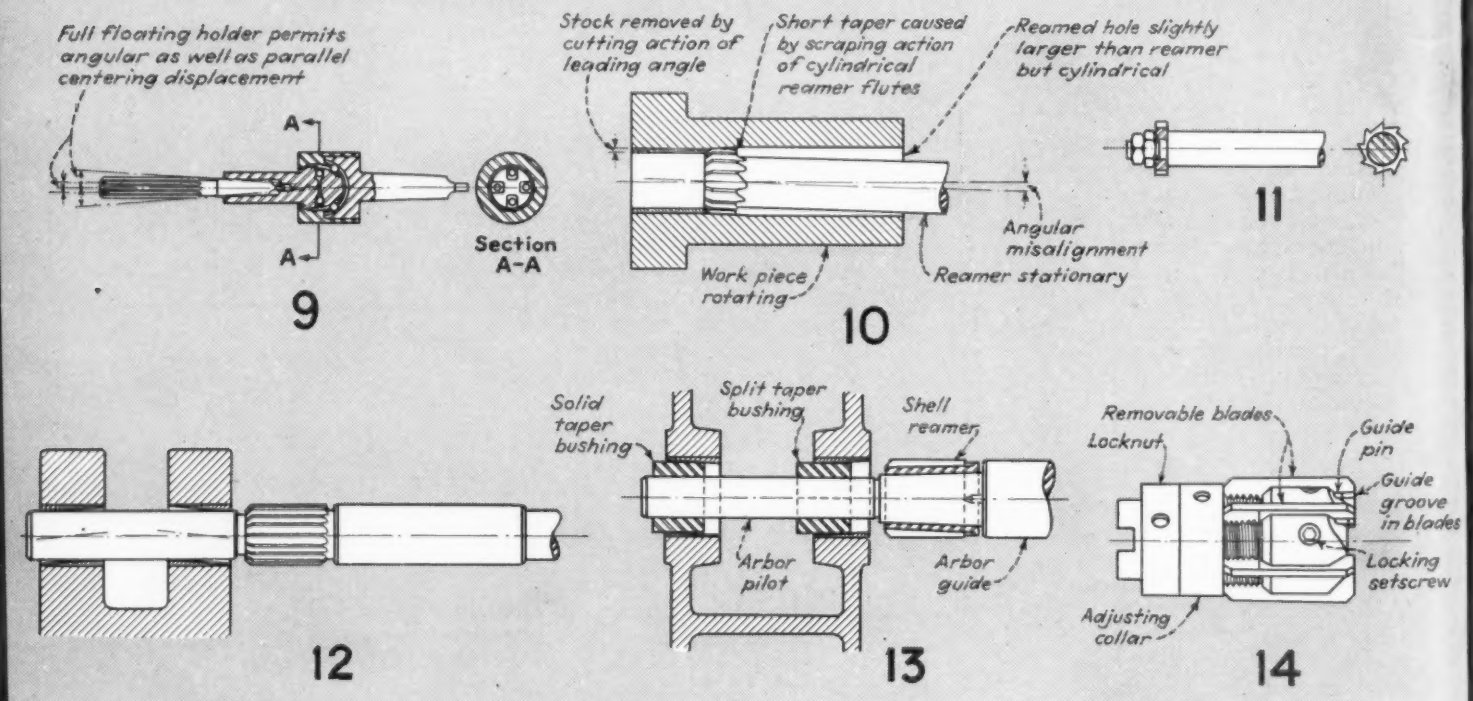
ment at the start of the operation, and will cut into the existing hole eccentrically as shown at *C* in Fig. 5. On a production job this is averted by reaming through jig bushings so that the work piece is centered before the reamer starts to cut. In such a set-up, the hole first is drilled through a hardened and ground slip bushing of drill size, then this bushing is exchanged for a slip bushing of reamer size as indicated in Fig. 6. In both cases of drill press reaming, the reamer must be held rigidly in the chuck or taper sleeve of the spindle, because only under this condition can it be centered with the work piece.

For more accurate work, the reamer should be held in a floating holder, so that it will center itself better with the existing hole. The principle is to allow the reamer point to move slightly in any direction by swinging freely about a center on the extended axis of the reamer inside the holder as far as possible removed from the cutting point of the reamer. This center usually is formed by a steel ball which transmits the axial force required for reaming. The torque required could be transmitted by a pin inserted in an over-size hole at right-angles to the axis, thus loosely connecting the driving and driven members. The connection is better made by a regular jaw clutch rendered flexible by the insertion of rollers or steel balls between driving and driven jaws, as shown in Fig. 7, thereby reducing friction to a minimum. This floating holder embodies the principles of the universal joint. Like any universal joint it permits only so-called angular float or angular misalignment.

Reaming on a Drill Press

The floating holder shown in Fig. 7 could be used in a drill press only if the hole to be reamed had been centered as nearly as possible with the drill press spindle, and the piece held rigidly on the table. The cutting action then would be the same as that shown at *A* in Fig. 5. At the start of the reaming operation the cutting pressure would then effect the final precise centering of the freely swinging reamer point with the upper end of the hole. As soon as the nearly cylindrical fluted portion of the reamer enters the hole, it will be guided or piloted by that hole. Where the hand reamer has a tendency to align itself with the existing hole, the machine reamer, when used in a drill press, has a tendency to correct the center line of the existing hole if it happens to deviate from the center line of the reamer at the time the cylindrical flutes have just entered the hole, as shown at *A* in Fig. 5.

When reaming bored or drilled holes on a screw machine or turret lathe, the problem differs somewhat. Due to the fact that the nearly concentric bore is turning while the reamer is held stationary, the point of the reamer will always be able to follow the existing bore. In the case of a misalignment, a



9. The full floating holder permits parallel center line displacement of the reamer in addition to angular float. With such a holder, the reamer is not properly guided until the flutes are well entered in hole

10. Short-fluted reamers produce more accurate work when the work piece is rotated. Only a short taper is caused by the scraping action of the cylindrical reamer flutes

11. Disk-type reamers have proven successful in a number of applications. Much tool steel is saved with this type

12. Line reamers can be hand or power operated. When power driven the holder must be full-floating type

13. Standard shell reamers can be mounted on arbors for line reaming. In this arrangement bushings align the pilot in the rough bored holes

14. Separate adjustable cutting blades can be used on hand and machine reamers. The blades can be made of almost any cutting material

Elementary Rules for Reaming

The following elementary rules hold true for all types of reamers:

1. Helical fluted reamers must be used when reaming holes with keyway or oil grooves, or which have an otherwise interrupted surface.

2. Straight fluted reamers usually are preferable where extreme accuracy is required.

3. Reamers always should be turned only in the direction of cutting, even when withdrawing from a hole—never turn a reamer backwards.

4. Rough and finish reamed holes have a superior surface finish to holes reamed in a single operation.

5. Better surface finish may be expected whenever provision is made for giving the reamer a uniform feed.

6. Some materials show an improved surface finish if a lubricant is used when reaming. The compound varies with the kind of material.

7. A cutting lubricant also may affect the extent to which a reamer will cut the hole greater than its own diameter.

8. High-speed steel blades lose their original keenness faster than carbon steel blades, but last longer.

9. A refined cutting edge has improved wearing qualities. Often a lapped reamer will finish ten times as many holes as a ground reamer.

tapered oversize hole will result as shown in Fig. 8. This is a condition that even a floating holder of the type shown in Fig. 7 could not prevent. However, the conicality of the hole can be reduced to a minimum by removing the center about which the floating reamer swings.

Avoiding Conicality

The problem cannot be solved by the full floating holder which permits parallel float, that is parallel center line displacement in addition to the angular float. Such a full floating holder is shown in Fig. 9. While the point of the reamer would seek to centralize itself with the hole, the shank end of the reamer would be free to whip back and forth sideways in the full floating holder, with what is known as a dog-tail motion. Only after the reamer has worked itself deeper into the hole will it attain the necessary guidance.

There is a simple way to ream holes on a lathe to a cylindrical, rather than a conical form. All that is necessary is to use a short reamer as shown in Fig. 10. As can be seen in Fig. 8, the tapered hole is not cut by the leading angle of the reamer, but is caused by a one-sided scraping action of the cylindrical reamer flutes. As long as there is perfect alignment, the greater portion of the nearly cylindrical flutes are inactive, but if there is misalignment the back portion becomes harmful.

The wastefulness of having the major part of an expensive cutting tool perform no function at all has been recognized in the development of the disk type reamer shown in Fig. 11. The thickness of a $\frac{7}{16}$ in. diameter reamer of this type is only $\frac{3}{32}$ in. It is said to ream accurately and to produce a smooth finish. There are, however, authorities who have expressed doubt whether the thickness of such a reamer is sufficient for proper guidance. Since this reamer has no chamfer its cutting action cannot be compared truly with the conventional machine reamer. Nevertheless, there is a noticeable trend today toward the use of shorter machine reamers.

Aligning Holes for Bearings

An important reaming process is that of aligning holes for bearings in machine frames. This necessitates a correction of the centerline of the existing holes and the cutting action must be that of the machine reamer, although the reamer very well may be operated by hand. All that is necessary to make a line reamer is to provide the machine reamer with a pilot of such length as to extend fully through the two or more bearings to be reamed, and also to provide a back guide of the same length to keep the reamer fully guided to the end of the cutting operation. In Fig. 12 is shown the cutting action of such a line reamer. Where the line reamer is to be power driven, it must be fully floating, since the center line of the reamer is fixed throughout the reaming process. Ordinary floating holders which permit only angular misalignment will not do. The full floating holder or shaft coupling capable of angular as well as parallel float is the device to use.

There seems to exist a notion among machinists that the ordinary hand reamer can be used for line reaming as long as the distance between the holes is short enough to permit the reamer to engage both holes at the same time. Nothing can be further from the truth. In such a case the reamer would tend to align itself with the first hole at the start of the operation. Later, when the cylindrical flutes enter the second hole, the reamer would be forced into a different alignment. Under such circumstances, no truly cylindrical hole can be produced.

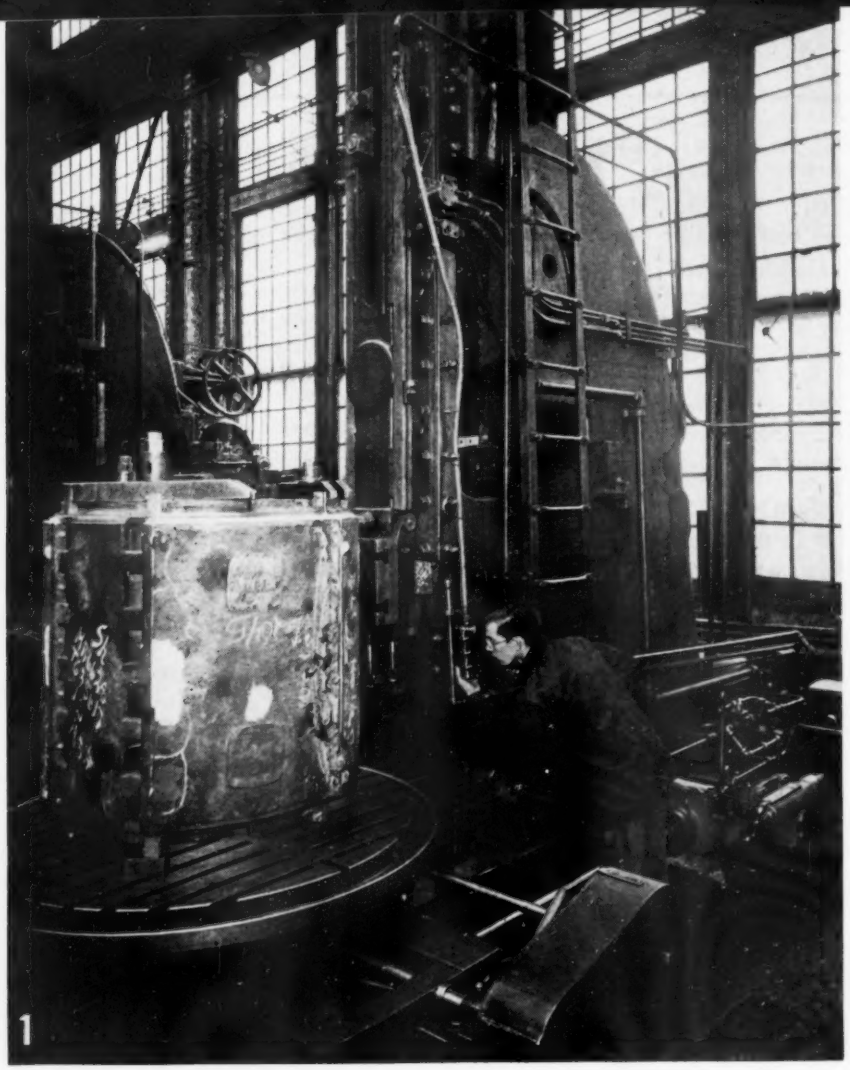
Line Reaming

Not even the hand reamer shown in Fig. 4 with a sufficiently long pilot and guide is well suited for line reaming. The slight taper at the start of the flute will exert a heavy side thrust when forced through the hole. The very essence of line reaming is to force the reamer through the hole more or less eccentrically. Side thrust is apt to cause a considerable amount of deformation if the casting or structure connecting the holes is not very rigid.

To give the reamer shown in Fig. 12 steady guidance, the holes should be bored to close tolerances. It is possible to do away with such undesirable accuracy on the rough bored holes by providing the arbor pilot with separate snugly fitting bushings which are slightly tapered on the outside so that they can be tightly seated even in rough bored holes of varying diameter. Fig. 13 shows such an arrangement with a standard shell reamer mounted on an arbor. One of the bushings is split lengthwise so that it can be removed after the first hole has been reamed without withdrawing the reamer. If the holes are of different size, both holes can be reamed simultaneously by having two shell reamers mounted on the arbor.

Hand reamers as well as machine reamers of both the shank and the shell type are also manufactured with separate adjustable cutting blades in sizes from one to 6 in. diameter. As shown in Fig. 14, the forward movement of the worn blades generally is effected by turning a threaded collar in back of the blades while at the same time a slight radial expansion of the blades is caused by longitudinal guiding pins which are slightly inclined against the axis of the reamer. The separate blades can be made of carbon steel, high-speed steel, or of shank steel with sintered carbide tips.

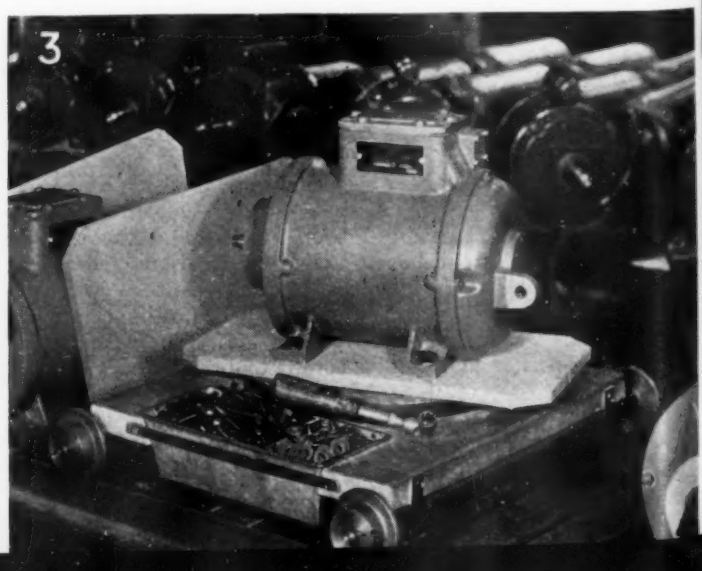
SHOP SHOTS



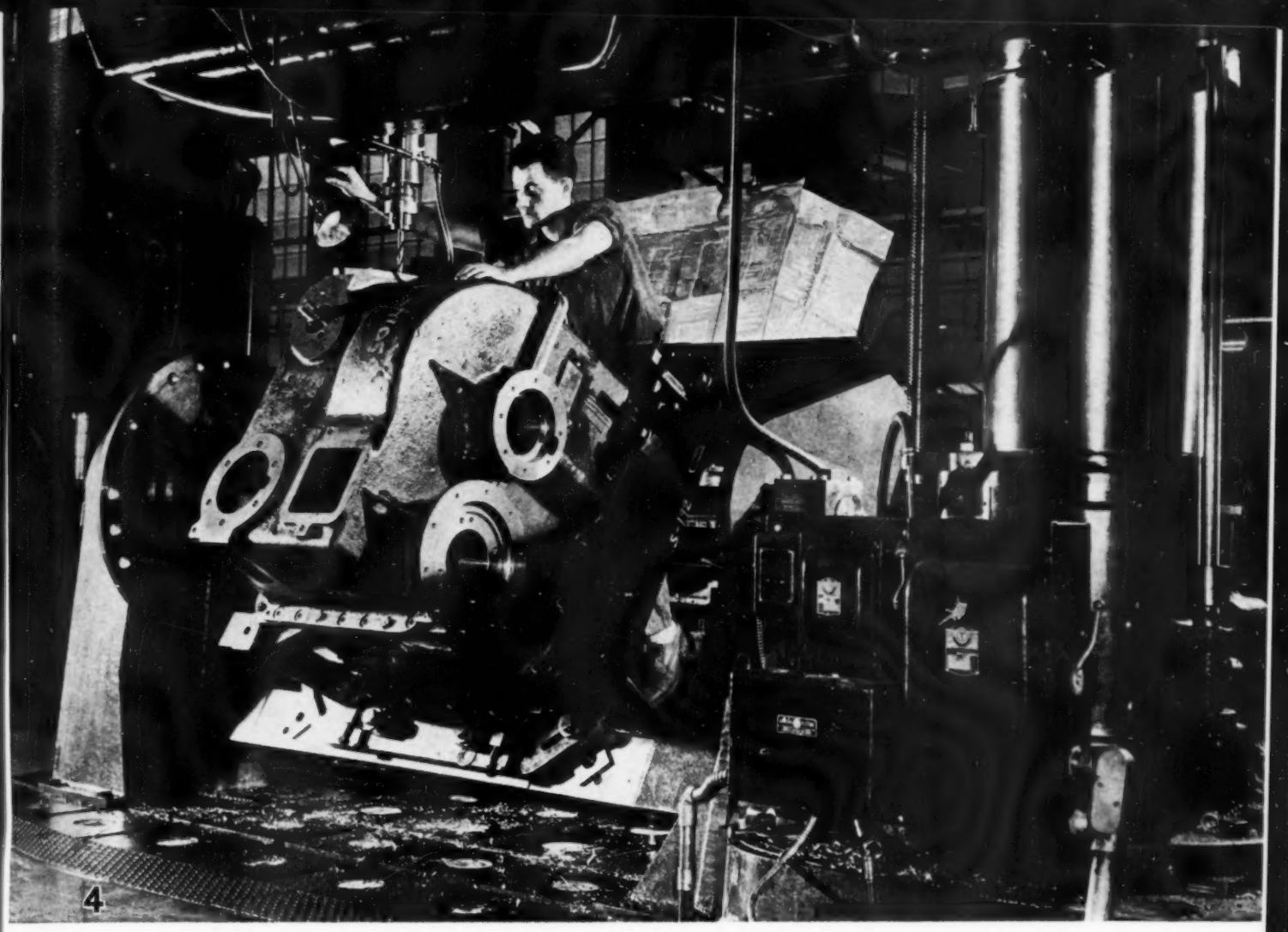
1. Closely spaced slots up to 57 in. long have to be cut in the semi-circular periphery of intercoolers for submarine generators. They are machined to a tolerance of 0.005 in. for a good fit with square water tubes. To perform this operation a 36-in. slotter was rebuilt with a stroke of 64 in. and a swing of 70 in. Because of this increase in capacity and the accuracy required, the base of the slotter was made heavier and extended for the larger table, the column was extended and stiffened, and the ram was reinforced. A complete hydraulic circuit was designed to provide variable feed and maximum convenience of control. Allis-Chalmers Manufacturing Company.

2. In the ignition harness of a Wright Cyclone Engine are two small drain holes to prevent the accumulation of moisture within the housing. When the engines are washed prior to shipping, these holes formerly were sealed with pieces of adhesive tape, but the washing fluid frequently seeped through. Clarence Boise, an inspector in the packing room, designed a special jack screw to seal the holes quickly and effectively. Wright Aeronautical Corporation.

3. Assembly operations performed on conveyors often include turning the apparatus. To expedite mounting small motors on skids or baseplates, a turntable unit mounted on a wheeled dolly. is arranged to roll along the side rails of a slat conveyor. After the motor has been placed on its baseplate on the dolly, two nuts are tightened. The assembly then is rotated and two nuts on the opposite side are tightened. C. T. Packer, Manufacturing Engineer, Lima Works, Westinghouse Electric & Manufacturing Company.



4. A universal indexing trunnion fixture developed to speed the drilling of marine gear casings has made it possible to save from 24 to 32 hours per week. This fixture permits positioning the casings for drilling at any angle in a full circle and at any plane. About 110 holes must be drilled, tapped or spot-faced in each of the casings, which vary in weight from 1,000 to 2,000 lb. Before the fixture was developed, a crane had to be used to reposition the casing after each surface was drilled. This meant turning each piece at least



six times. Now the work is set up once on a table which can be turned completely around in either direction. With the table locked in the desired position, the casing can be rotated end over end by an electric motor drive. Movement is controlled by pushbuttons. General Electric Company.

5. Hudson bomber belly gun mounts held in the warehouse until needed on the assembly line are stacked in special racks which conserve storage space. These racks are mounted on removable casters, so that the casters may be removed to permit stacking the racks one above the other when space permits. Lockheed Aircraft Corporation.

6. Special machine tools have been designed in a Ternstedt Manufacturing Division plant to keep production on one of America's most powerful types of anti-aircraft guns. These machines were designed and built by Ternstedt because the ones normally needed for the work could not be obtained for 18 months. In the dual operation shown, the man at the left is operating a driving head equipped with a boring bar, while the man at the right, using an identical machine, is facing a surface on the gun carriage. These machines are set up so that spindles can work simultaneously. Fisher Body Division, General Motors Corp.

The tips of electrodes on alternating current welders must be dressed at frequent intervals to remove "pickup" and prevent sticking to the work

How to Spot Weld Aluminum

Correct electrodes are the key to consistent welds. How to choose and clean electrodes. How to test the finished weld

This is Part 2 of a two-part article. Part 1 (AM—Vol. 86, page 1487), covered welding equipment, time, pressure, and cleaning of metal surface

TO OBTAIN CONSISTENT spot welds on aluminum, care should be exercised in choosing electrodes of the proper shape and in maintaining this shape during production. The electrodes serve three functions: (1) they conduct the welding current into the parts being welded; (2) they exert enough pressure on the material to hold it in place; and (3) they conduct the heat away from the metal surfaces with which they are in contact so that the weld zone does not reach the outside planes of the material.

As it is necessary that a high concentration of current reach the weld point, at least one of the electrodes must be of a shape that will facilitate such concentration. This electrode may be dome-shaped (with a 1- to 2-in. radius) or conical (with a 158- to 166-deg. included cone angle). With the energy-storage welding processes, another shape is often used—a truncated cone (with a 130- to 160-deg. cone angle and a flat spot at the end having a diameter equal to twice the thickness of the material welded, plus $\frac{1}{8}$ in.). The electrode on the other side of the work may be of the same shape, but frequently a flat electrode is preferable to keep electrode marking to a minimum. Flat electrodes may be from $\frac{5}{8}$ to $1\frac{1}{4}$ in. in diameter, as larger electrodes result in no further improvement of weld appearance.

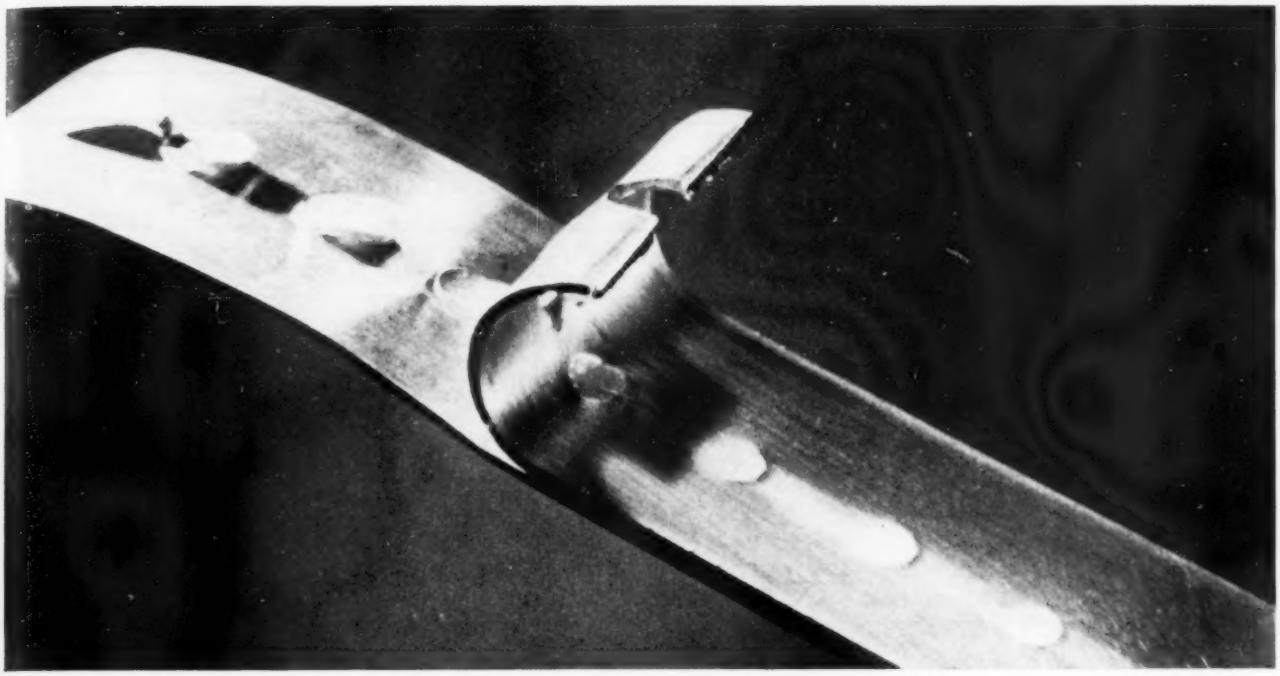
All electrodes must be made of material of sufficient hardness to maintain their shape in production welding while having high electrical and thermal conductivity. A number of copper alloys, suitable for the purpose, have hardnesses greater than Rockwell B-65 and conductivity more than 75 percent that of pure copper. Generally speaking, hard-drawn conical or dome-shaped copper electrodes will not maintain their shape in aluminum welding. Truncated-dome tips, however, can be used if the welding pressure employed is not too great for the electrode's size.

To carry the necessary welding currents without undue heating, electrodes must be of proper diameter. For currents up to 35,000 amp. and welding times up to 15 cycles or the equivalent, a $\frac{5}{8}$-in. electrode is suitable if the welding rate is not over 40 welds per min. With higher currents or greater speed, $\frac{7}{8}$- to $1\frac{1}{4}$-in. electrodes will be needed. If the indicated welding current is less than 20,000 amp. and welding time shorter than eight cycles, electrodes of $\frac{1}{2}$-in. diameter are satisfactory.

The electrodes of spot-welding equipment must be water cooled and are provided with a water-cooling hole which should extend to within $\frac{3}{4}$ in. of the welding face of the electrode. A water flow of from 2 qt. to 1 gal. per min. should be maintained.

Keeping Electrodes Clean

A layer of aluminum alloy gradually forms over the face of electrodes in service. Eventually the layer will cause electrodes to stick to the work and melt the surface of the welded material if not removed. To avoid this, the alloy "pickup" should be dressed off the electrode welding surfaces with No. 160 or No. 240 abrasive cloth. The dressing



Each successful spot weld, when subjected to the "peel" test, should pull a button of metal equal in diameter to twice the total thickness of the weld material, plus 1/16 inch. Too small spots call for increased welding current

of dome-shaped electrodes should be done with particular care to avoid distorting the original tip shape.

The tips of dome, or cone-shaped electrodes on alternating-current welders must be dressed to remove "pickup" after from 15 to 80 welds, depending on the character of the welded material. Less "pickup" occurs when truncated-cone electrodes are used on energy-storage equipment, and from 60 to 300 welds are possible before electrodes require dressing. The tip-cleaning operation requires only two or three seconds in any case.

Sample Welds for Testing

When the welding equipment is set up for a spot-welding job, sample welds should be produced to test the correctness of machine settings before proceeding. As a basis for trial welds, the settings given in Table 1 (*AM*—Vol. 86, page 1488) should be applied if alternating-current machinery is being used. (Necessary variations for magnetic- or condenser-energy-storage equipment are indicated under previous headings.)

Trial welds should be made on sample or scrap stock of the same quality, dimensions and surface condition as the material to be welded on the final job. Spacing of trial welds should also be the same as in production. After the test run, the specimen can be checked by a "peel" test or by chiseling the welded sheets apart.

Each successful spot weld should pull a button of metal equal in diameter to twice the total thickness of the welded material, plus $\frac{1}{16}$ in. Spot diameter, if too small, may be increased by raising the welding current in 1,000-amp. steps. Welding pressure is too low if expulsion of metal between the sheets takes place. Excessive darkening of the sheet on the outside, surface melting, or sticking of electrodes after only a few welds have been made indicate either that current should be decreased or the pressure increased.

Tests on Alcoa alloys 17S-T and 24S-T, Alclad 17S-T and Alclad 24S-T will not always pull buttons completely through the sheet if the material is thicker than 0.081 in. The tests should be made in the same way, however, and be judged in such cases on the diameter of the fractured area resulting.

The thickness of the material on the side which comes in contact with the domed or conical tip governs the machine settings and weld diameter when welding sheets of unequal thickness. If domed tips are used on both sides, the settings should be based on the thinner sheet. Where more than two thicknesses are to be welded, the outside sheets determine what the settings should be, but slightly higher values of current and pressure are necessary.

If changes in the machine settings do not entirely eliminate expulsion of metal between the sheets, improper cleaning is likely to be the reason. A light rubbing with steel wool on the welding surfaces just before starting will frequently eliminate the trouble.

Cracking may occur in spot welds on plain or Alclad 17S-T and 24S-T if welding current is too high or the pressure used is too low. Use of domed electrodes with larger radii, or dressing a small flat spot (no larger than twice the thickness of the material, minus $\frac{1}{16}$ in.) on the domed or cone tips, will reduce or eliminate this tendency.

Spot-welded structures of Alcoa alloys 2S, 3S, 52S, 53S and 61S can be expected to give the same service as the unwelded material where corrosion is concerned, as these alloys are not selectively attacked. Spot welds in 17S-T and 24S-T alloys may, however, be affected under severe corrosive conditions and spot-welded structures of these materials are to be avoided where corrosion is an important factor.

The pure aluminum surface layers of Alclad 17S-T and Alclad 24S-7 offer electrolytic protection against corrosion in welded joints of these materials. Best resistance is obtained when the weld does not extend through the coating. When 17S or 24S alloys are spot welded to Alclad 17S or Alclad 24S, the pure metal surface of the Alclad material offers some electrolytic protection to the uncoated metal.

Determining Weld Strength

Generally speaking, spot welds are designed to carry sheer loads. The type of alloy, thickness of the material, and the machine settings determine the weld strength. Minimum values of

Table 2. **Minimum Shear Strength of Spot Welds**

THICKNESS OF ONE SHEET OF TWO EQUAL THICKNESSES WELDED, INCHES	ALCOA ALUMINUM ALLOY WELDED						
	2S-½H 2S-H	3S-O	3S-½H 3S-H	52S-O	52S-½H 52S-H	53S-W 53S-T 61S-W 61S-T	24S-T AND ALCLAD 24S-T
	LB. PER SPOT	LB. PER SPOT	LB. PER SPOT	LB. PER SPOT	LB. PER SPOT	LB. PER SPOT	LB. PER SPOT
0.016	40	40	55	90	90	90	120
0.020	55	55	75	120	120	120	160
0.025	70	70	100	170	170	170	215
0.032	110	110	140	240	240	240	300
0.040	150	140	190	340	340	340	430
0.051	205	180	280	500	510	510	620
0.064	280	230	390	700	720	720	840
0.081	420	340	570	940	1000	1000	1080
0.102	520	480	800	1210	1320	1320	1320
0.125	590	710	1000	1450	1620	1620	1450

Values given in this table are about 65 percent of average strength obtained when weld diameter is twice the thickness, plus 1/16 inch.

shear strength for various thicknesses and alloys are shown in Table 2. Welds made according to the proper machine settings, and having a diameter equal to twice the thickness of the sheet, plus $\frac{1}{16}$ in., will exceed the minimum strenghths given in Table 2, regardless of which type welding machine is employed. Production of welds having smaller size than those listed in Table 2 is to be avoided, since under production conditions the result is likely to be no weld at all.

Designs for Spot Welding

Secondary stresses in the form of tension loads often exist in spot welded structures. Where it is important that tensile strength of welds be known, special tests should be made because these strengths vary from 20 to 90 percent of the relative shear strengths.

The primary consideration in the design of structures to be spot welded is that the work surfaces of the material be of such shape as to allow them to be normal to the axis of the electrodes, and that no other part of the structure comes in contact with any uninsulated portion of the welding machine. The throat depth of spot-welding machines is usually limited to about 50 in., hence structures should be designed so that the maximum distance from the edge to the weld location is less than that.

The welding operator should be able to obtain a full view of the spot locations on the surface which comes in contact with the upper electrode, to facilitate accurate placement of welds and to increase production speed.

The dimensions of electrodes and electrode holders place some limitation on the design of spot-welded structures. Electrodes of $\frac{5}{8}$-in. diameter, and holders of 1-in. diameter (the sizes frequently used in aluminum welding) require a minimum distance from the center of the weld to any upstanding flange, for instance. For the welding of parts with overhanging flanges, special offset electrode holders can be used, but the amount of offset possible is limited by the pressure required for welding and the strength that can be built into a holder.

When spot welds are placed close together, a portion of the welding current will be shunted through the welds already made. If the spacing is less than eight times the thickness of the material welded, this current loss results in welds of lower strength. To overcome this, higher values of welding current should be used on all welds after the first.

The number of spot welds required per inch of joint can be calculated by dividing the average strength of the individual spot welds (as indicated in Table 2) into the strength of the material welded per lineal inch. When tested, joints correctly designed will usually fail by tearing along the edges of the spots.

Pipelines and Tanks Aid Oil Handling

The handling of eight different petroleum products has been simplified and made safer, through a system of central storage and pipeline distribution, in the local plant of the Union Drawn Steel Division of Republic Steel Corporation. Stored in a ventilated underground vault, oil is received from trucks through filling pipes brought up inside an accessible concrete inclosure. Supply lines carry the oil to machinery, or wherever it is needed throughout the plant. To aid in identifying the lines, each is painted a distinctive color, according to the oil it carries.

Gear pumps, driven by explosion-proof motors and equipped with relief valves on the pump heads, are used on all eight lines fanning out from the central storage vault. On the soluble oil and the drawing oil installations, where an interruption to supply would seriously inconvenience plant operations, an extra standby pump has been installed in the line at each set of storage tanks.

Slushing oil, used to spray protective film on finished stock as it is loaded into railroad cars, is forced to eleven stations along the track loading zone, where spray gun equipment on 25-ft. lengths of hose can be attached. Adjacent are outlets from the air compression line. Oil and air outlets have been equipped with fast-action couplings for quick station changeover.

Power—Giant Arm of Production

Ninety Per Cent of American Industry Is Electrified

ELECTRICITY is the mainspring that turns the wheels of our factories, mills and mines. It is the tireless arm that grinds our grain, weaves our cloth, pumps our water, builds our planes, our guns, our ships, our cars, our trucks and tanks . . .

The mighty Pharaohs had less energy at their disposal in building their pyramids than is generated today by one single power plant. The combined capacity of America's central power systems is without parallel in the history of the world . . . 46 million kilowatts, i.e., 65 million horsepower in steam turbines, hydro turbines and other prime movers. That is more power, day in and day out, than 650 million slaves could produce—for a limited time—minutes in fact.

The capacity of this vast fountain of energy is beyond the grasp of the average man who flips a switch and sets in motion machines that perform the labor of a thousand man-hours in a matter of minutes. Perhaps only the old time farmer, whose traditional source of power is a team of tired horses and a pair of calloused hands, knows how to appreciate this commodity that is so vital an ingredient of everything we consume and use.

Yes, we take electricity for granted. We expect it to appear in unlimited quantities, like water and air, as we need it. Almost as essential as these two elements in times of peace, it becomes a matter of life and death in times of war. Industry would collapse without it and the nation would quickly perish.

With the catastrophe of Pearl Harbor a little over a year ago, came the realization that we had to out-produce our enemies. To out-produce our enemies, who had a seven year head start, meant to turn more wheels than they were turning and to turn them faster than they were turning them.

New plants sprung up overnight. Production increased beyond our wildest dreams. Aircraft and shipbuilding surpassed the most daring forecasts. The machine tool industry's output grew to a volume that bordered on the miraculous. Guns, shells, uniforms, shoes, tanks and a thousand other items were being made in hitherto undreamed of quantities. All of them have one common essential ingredient – power. Industry demanded power – more and more power!

It is no small tribute to the power industry that, while other raw materials developed shortages necessitating strict priorities control, electricity remains unrationed – no priorities, no curtailments, no rate increase. Current industrial consumption is running 16 per cent over 1941 and 50 per cent over 1940. Not spectacular perhaps but when we consider that the nation's 26 million domestic consumers utilize only about 14 per cent of the energy output, we begin to get some idea of industry's power consumption.

Our power companies might have been stunned by the prospect of mounting demands for kilowatts. Instead they set about developing and coordinating a multiplicity of relatively small and seemingly unrelated factors. Individually or even collectively, these have not been of a spectacular nature. Certainly they have not inspired the award of the Army-Navy E although they are an essential ingredient in every Army-Navy E that has been awarded to American industry.

The contribution of the power industry to the winning of the war is not likely to flame forth in newspaper headlines. It takes the more prosaic turn of portraying an industry that is doing wonders quietly, unobtrusively.

At the close of the last war the power at the disposal of the American industrial worker averaged 3⅓ horsepower. At the beginning of this war, twenty years later,

This is the seventh of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

it had increased to 6½ horsepower. What other nation can even approach that figure? This large provision of power is the achievement of the electric utility industry. For years it had built and applied its equipment to the highest standards of performance and operated its systems to equally high standards of service and dependability. Always recognizing that "public service is a public trust" it had maintained wide margins of security in performance. Today these margins are the source of the power industry's ability to rise to the emergency.

In short, the electric utilities were prepared!

Power men are accustomed to looking ahead, to prepare for growing loads and allow for unforeseen contingencies, for electricity cannot be stored. It is "ordered" by touching a switch. It is delivered and consumed at the same moment.

Months before the actual outbreak of hostilities foresighted power men set to work computing how much life of equipment could be risked in the process of crowding it toward greater output. Generators, boilers, turbines, cables, transformers and even conductors underwent close scrutiny in an effort to increase the load – *safely*. They figured, they experimented, they tried untried measures.

Insulation, for example, is the crux – the least known component of electrical apparatus. When it lets go the service suffers. It is not easy to know how near any bit of crucial insulation is to letting go. It takes courage to work it to a point just short of failure . . . but that is exactly what is being done today.

Technological forcing of equipment, however, is not all of the story. Obsolescent equipment has been rehabilitated; salvage has been intensified; critical metals have been replaced by non-critical materials; water sprays, air-blowers and other cooling methods have been installed to keep over-loaded apparatus from over-heating. Nothing has been overlooked. Ingenuity has contrived the well nigh impossible.

Hand in hand with these measures of expediency have gone measures of intensification. Hydrogen pressure for cooling generators has been stepped up from ounces to pounds taking more heat away from the machines and enabling them to carry greater loads. Capacitors – little more than aluminum foil interleaved with thin paper – have been applied by the carload relieving the systems of that mysterious reactive current which is associated with that equally mysterious power factor. They have performed wonders in avoiding the need for additional generating and transforming equipment. The use of portable sub-stations has averted the otherwise necessary reserve capacity in fixed installations at many points.

When coal was placed on the urgent list last spring the electric utilities outstripped all other industries in providing storage for the winter. Stocks on hand the first of October were sufficient for 105 days, or more than twice what would be considered adequate in times of peace.

When staff losses to the armed forces became serious power companies contrived measures that enable them to get along without aggravating the national manpower situation by hiring others to replace them. Today meters are being read every two or three months instead of monthly; women are being trained to do drafting, keep the logs in power plants and sub-stations and to test meters in shops and laboratories.

On the summit of "Grandpa's Knob", a mountain overlooking Rutland, Vermont, stands a giant windmill that would have been the delight of Don Quixote. Towering 200 feet above the tree tops its mighty 175 foot propeller turns with the wind and drives a 1,000 kilowatt generator which feeds its output into the Central Vermont Public Service Corporation's power system. The most ambitious wind-turbine generator in the world, and a daring experiment of forward-looking men.

Today everything electrical is being tried; is being worked harder than it has ever been worked before.

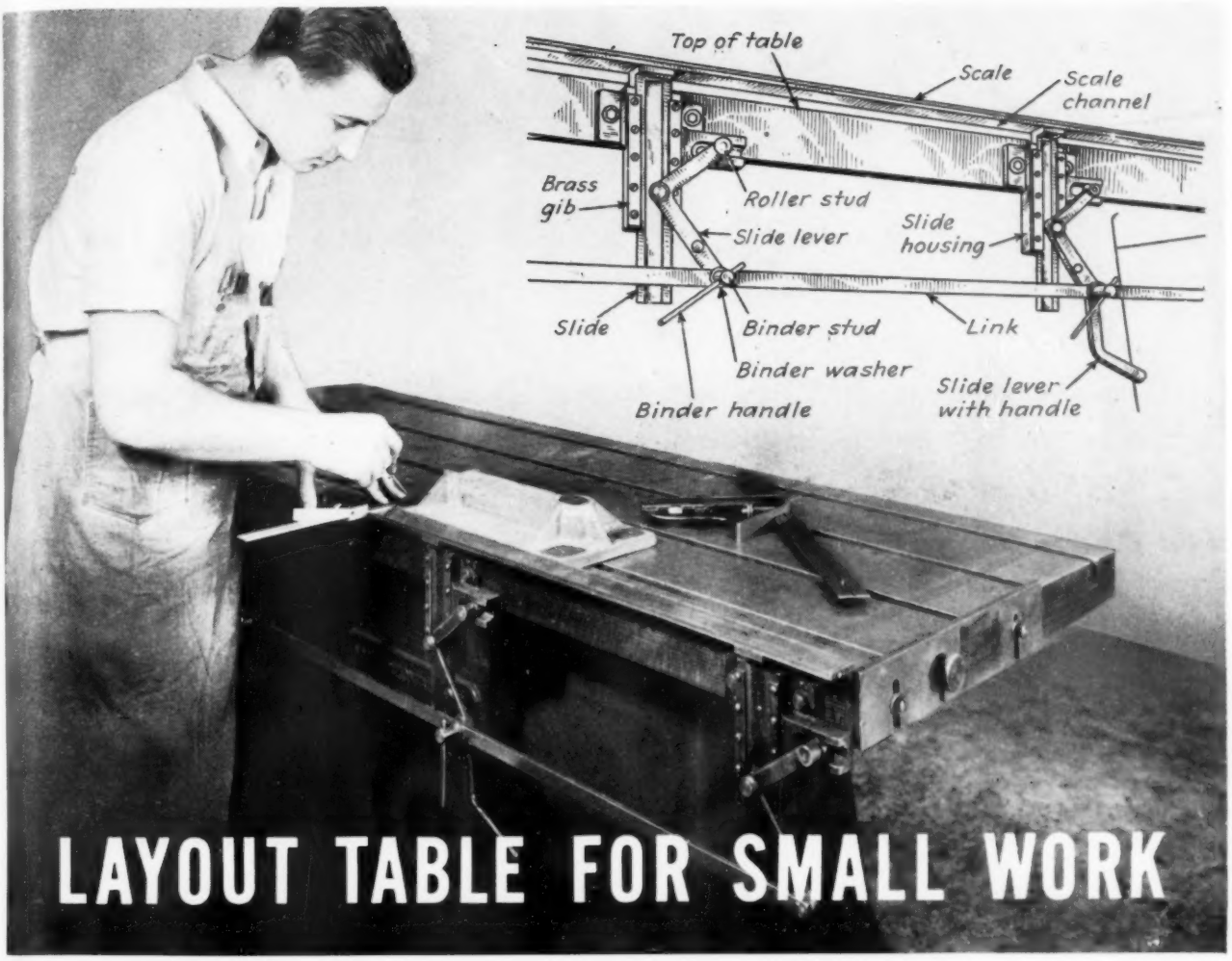
Great credit is due the men behind the electric power industry. These men have recognized the responsibility of their jobs – it is a part of their very being. Theirs is the kind of service that *must* be maintained. No soldier is truer to his trust than is the employee of this great industry.

The service must go on! No matter what happens – acts of God or deeds of men – the service must go on! Labor disturbances may disrupt other industries but there have been no shutdowns due to labor trouble in electric power plants since Pearl Harbor.

And this winter when blizzards pile up drifts and sleet makes pavements slippery there may be absenteeism from other plants but the utility employees will be on the job ready to climb the ice-covered poles and repair the ice-laden lines whenever the call comes.

In this war the least costly yet the most precious element of production – electricity – will be ever ready to "man" the machines that will produce the weapons that will give victory to the forces of freedom.

President, McGraw-Hill Publishing Company, Inc.



LAYOUT TABLE FOR SMALL WORK

Layout of small castings for drilling has been speeded by providing a long scale mounted on an elevating mechanism at one side of this special table. Stop plates adjustably mounted at each table end help position castings for layout

BY HENRY ASCHENBACH AND DONALD RAE, PACKAGE MACHINERY COMPANY

CONSIDERABLE TIME has been saved in the layout of small castings for drilling and other machining operations by providing a special layout table having a 72-in. scale along one side. This scale is fitted on an elevating mechanism that can raise it to the height of the working surface being marked.

To form the table of this unit, the base of a wornout horizontal drilling machine was salvaged from the scrap pile. The top measured 24 × 66¼ in. A 5¾-in. cast iron extension was bolted to one end to make the table surface 24 × 72 in. Both the top and the face of the table were scraped true and the four T-slots in the top were cleaned out. These slots have proved useful for bolting castings in position for layout operations.

Four cast iron housings have been bolted in vertical positions on the front side of the table. Housings are 21⅞ in. between centers. Two slide ways are machined in the front face of each housing. One of these ways is 1½ in. wide and ½ in. deep, and is in a vertical position when the housing is bolted to the table. The second slide way is at right angles to the larger way. In it slides a roller fitted to the operating lever mounted on the vertical slide. The bottom of each of these two ways is cut away with a deeper channel, leaving bearing surfaces at each side.

In each of the four vertical ways is fitted an accurately machined cast iron slide 10 in. long, which has a projection at the top end; this projection is drilled and tapped for a machine screw for mounting the scale channel. A pad near the center of each slide is drilled and reamed for a $\frac{5}{16}$-in. diameter bearing pin. Brass gibs mounted at each side of the vertical way on each housing bear against the vertical slides.

Mounted across the tops of the four vertical slides, in accurate alignment with the top and front surfaces of the table, is a 72-in.-long, cold-drawn-steel scale channel. The channel piece is machined in an L-shape to provide space for a rule 0.100 in. thick and $1\frac{7}{16}$ in. wide. At each end of this channel is an end plate to keep the rule in position.

A slide operating lever is provided for each slide unit. Each is a 90-deg. bell crank. One of the four levers has a handle extension for adjusting the elevation of the scale. Connecting the lower lever arms of each bell crank is a steel link bar with four holes on 21⅞-in. centers. The two outer levers are connected to the link bar with stepped screws, while the two inner levers are connected with binder studs having handles for locking the link bar to the levers when the scale has been elevated to the desired height. The maximum elevation possible with this arrangement is 6 in.

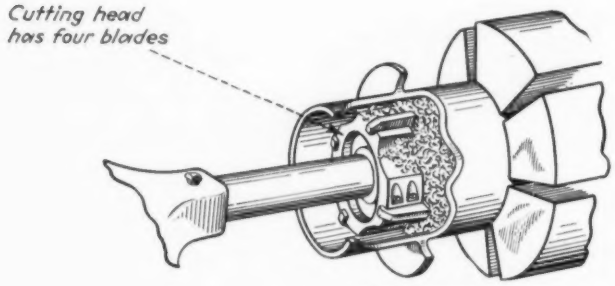
War Winning SUGGESTIONS

The following ideas were selected from those recognized as meritorious by the Board for Individual Awards, War Production Drive. They are freely offered to industry as an aid to its war production.

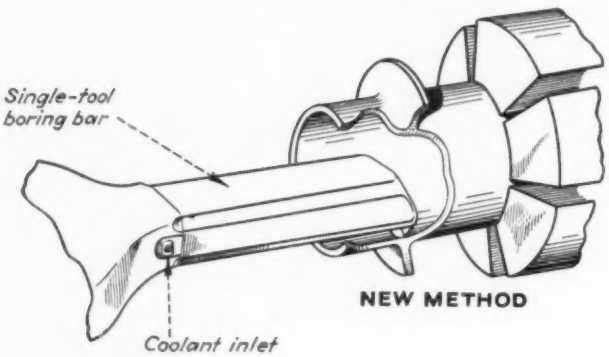
New Cutter Increases Production

The illustrated change in the boring tool used on Potter and Johnston turret lathes for rough boring the inside of a marine engine cylinder increased production from 7 to 21 pieces each eight-hour shift. Therefore, for the same quantity of production, two machines and six operators on three shifts are being saved, in addition to the cost of the extra tools. On a yearly basis, this means a saving of approximately $18,000 in operators' time alone, as well as making six men available for other work.

The work was formerly done with a four-bladed cutter,



OLD METHOD



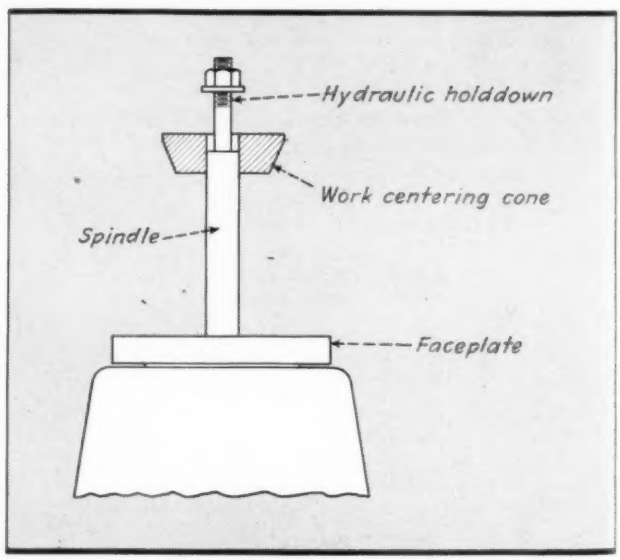
NEW METHOD

the blades being set 90 deg. apart around the perimeter of the cutter head with flutes in between for the clearance of turnings. The cylinder is open at but one end, and in operation the turnings clogged ahead of the cutters to a point where the machine had to be stopped for their removal. As one operator was running three machines and could not watch all three constantly, damage to the machine occurred frequently. The cutting blades also required frequent sharpening, since it was difficult to keep a constant flow of coolant on them.

The tool holder for the new set-up has but one blade located at the bottom of the cylinder. The coolant now flows through the holder and on to the cutting surface from a point just above the cutting blade. With the cylinder rotating, this cutting tool is accordingly well immersed. The forward face of the holder is sloped backward and with a much smaller cross-sectional area than that of the holder previously used. The turnings pass over the top and out so that the entire operation can be performed without shutting down the machine. *Suggested by Loomis I. Walden, Marine Engine Division, Packard Motor Car Company.*

Centering Cones Replace Bushings

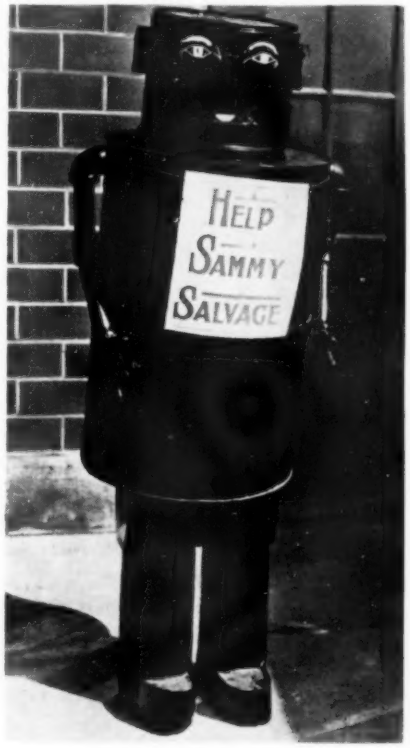
When holding gear blanks on the faceplate of a machine for rounding the gear teeth, it was customary to use a separate spindle bushing for each size bore in the various blanks. By using three work-centering cones, each progressively larger than the other, 50 to 60 bushings have been



discarded. This not only saves time previously spent in looking for the proper size bushing for any one gear blank, but it also saves material required for such bushings. It is estimated that the use of the work-centering cones will create 100 hours additional production time for each machine every year. *Suggested by John W. Westlake, Williametter Hyster Company.*

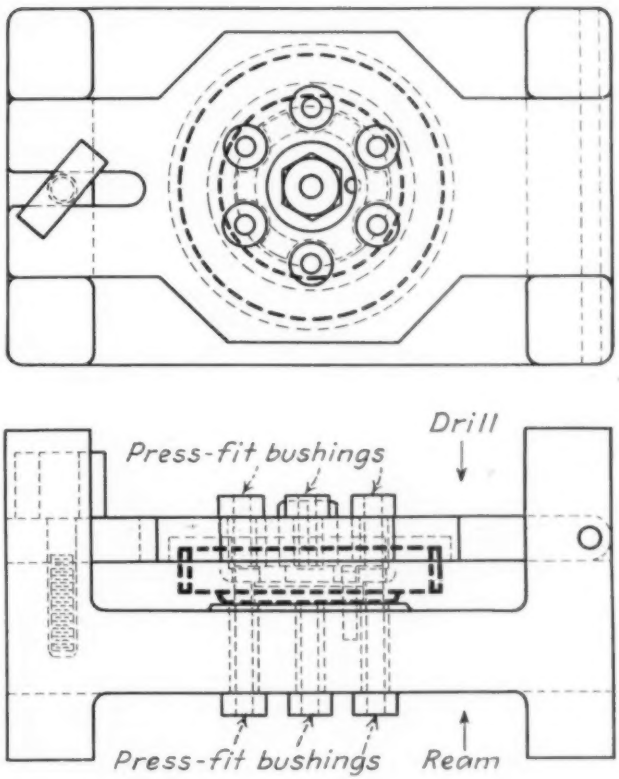
Robot Helps the Scrap Drive

It is suggested that the illustrated robot, made from salvaged cans and miscellaneous scrap, be used to advertise the national scrap drive. This robot was built by the suggestors and used to advertise the scrap drive in the schools of Baton Rouge, La., as well as at factory gates. A man outside the robot supplies the motivating power. A loud speaker transmits a recorded message, adding to the robot's effectiveness. *Suggested by Norval H. Douglas and Robert W. Stephens, E. I. duPont deNemours & Company, Inc.*



Single Jig for Drilling and Reaming

The jig commonly used for drilling and reaming six holes in a gear of the intermediate dual-accessory drive of high-powered radial aircraft engines has two bushings, one to guide the drill and one to guide the reamer. Each hole is drilled in turn, using the same bushing. The reamer bushing is used in a like manner. Continually removing and replacing these bushings requires considerable time. The jig



shown in the drawing eliminates this handling of the bushings, since it has a bushing at each station pressed permanently into place. The gear is placed in the jig and drilled from one side, after which it is turned over for reaming. *Suggested by Frank Roudebush, Wright Aeronautical Corporation.*

Pull Lift Raises Freight Car Sheets

It is customary practice in railroad freight-car repair shops to remove old side sheets from cars and place new sheets in position by a crane truck. The repairmen stand on platform ladders adjacent to the car. This method can be replaced by using the illustrated ladder device. It can be operated by two men more effectively than can the crane truck because the sheet can be properly aligned by a slight pressure of the hand; on the other hand, the mechanical power of the crane truck might cause disastrous results should the sheet become obstructed in any manner.

Such ladders can be made from angle iron and strap stock, assembled by drilling, reaming and riveting. The angle-iron support bar at the top should be at least 12 in. longer than the widest side sheet. The device can be used in box, gondola and hopper cars.

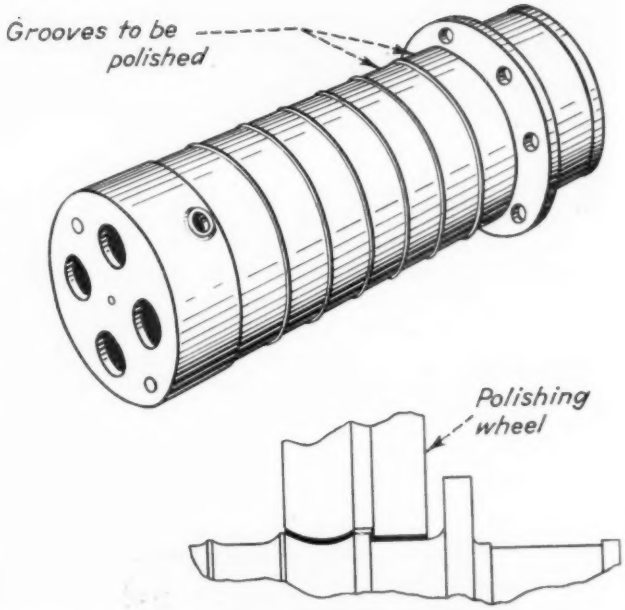
By using the suggested ladder device inside the car, the pull lift attached to the top support bar of the ladder raises the sheet into position. This also allows the ladder to be used in applying fit-up bolts, as well as reaming holes for riveting. The device releases crane trucks for other work and provides additional room beside the car being repaired.

It has been found that repair work on cars has been expedited through using this pull lift and ladder, thereby making car available for service in less time than was possible through use of crane trucks. *Suggested by Arthur L. Foutch, Illinois Central System.*

Speeds Polishing of Engine Barrels

The two grooves adjacent to the flange on each cylinder barrel of high-speed gasoline marine engines must be polished. Originally each groove was polished separately, requiring two wheels and two operations. It was first suggested that two wheels could be used simultaneously with a spacer between them, thereby eliminating one operation. Later, however, a double wheel was developed for the job, as shown in the drawing, which performed the work in one operation at greater speed.

Maximum output with the old method was 64 pieces each eight-hour shift. This was increased by 50 percent to 96 pieces through use of the double wheel. Formerly twelve single wheels were used on each shift. Because of the greater rigidity of the double wheel, subjecting it to less wear than a single wheel, only three are now used by each eight-hour shift. Furthermore, the double wheel produces



a better finish. The estimated saving through the adoption of the double wheel for this job is $4,000 annually. *Suggested by Norbert A. Zielke, Marine Engine Division, Packard Motor Car Company.*

Phenolized Canvas for Cams

Standard cams for screw-machine operations are cut from steel and are designed for long life. For jobs with a definite production of 10,000 to 40,000 parts, a cheaper type of cam could be used and discarded after the run. It was suggested that cams made of phenolized convas could be produced locally by manual methods in much less time that is required when ordering steel cams. The suggestion was adopted, and the cams used successfully for runs of 25,000 parts. Many applications are being found for these cams as new jobs arise or as changes are required on old ones. Aside from saving strategic material, there has been a great saving in man- and machine-hours in producing cams. *Suggested by Eugene A. Kruse, Western Electric Company.*

Six Shafts Ground Instead of One

The tongue on the shaft of the supercharger clutch-control valve in one type of radial aircraft engine has to ground. The fixture shown in the drawing makes it possible to grind six pieces at one time, instead of one piece as was the case with the fixture used previously. Once the shafts are set in the new fixture, both sides of the tongue can be ground without disturbing the set-up. Previously, one side of the tongue was ground, the shaft was turned around, and the

other side of the tongue finished, requiring two operations.

The assembly of the new fixture is shown in the drawing. Base *A* is placed on a magnetic chuck of a surface grinder. Revolving center *B* is placed in a hole drilled and ground through *A* and is held in place by two screws, through the top of *A*, that work in grooves *D*. These screws are used to remove play in center *B*.

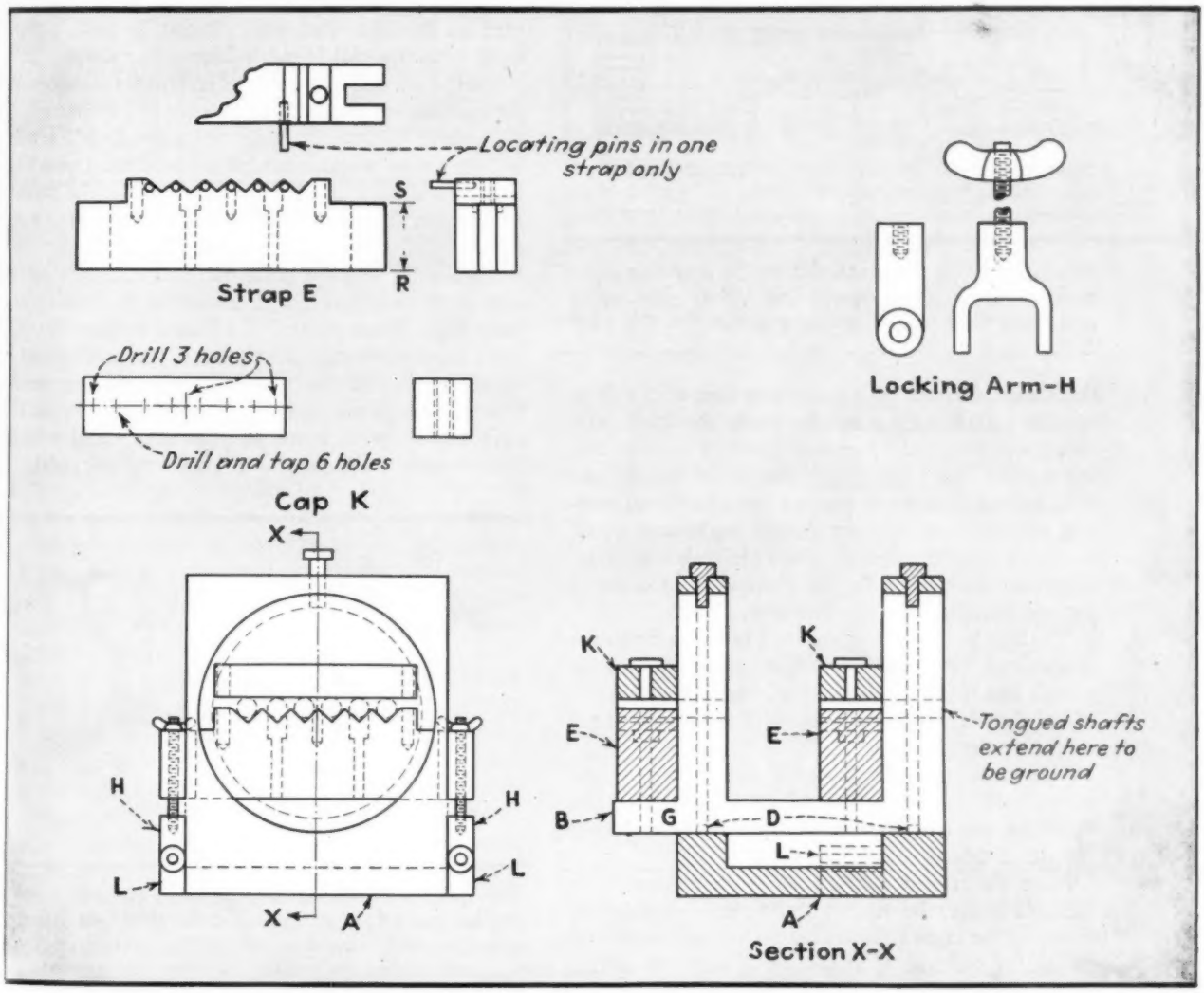
Shaft-holder straps *E* are assembled to center *B* as shown. One of these straps has six locating pins for locating it precisely on *B* at position *G*. The other strap is made without these pins and is 0.0045 in. larger through *R-S;* this is to compensate for the step ground in the end of this part. These straps are so made that when they have been assembled on center *B* the center line of the tongued shafts placed in the vees will be off center 0.028 in. in relation to the center line of *B*. This is done because the tongue is off center from the shaft 0.056 in.

Two locking arms *H* are made with a projecting stud for the application of a wing nut. These are held to base *A* by straps *L*, using straight pins at the two hinge points.

After the fixture is assembled, the tongued shafts are placed in the vee grooves of parts *E* with positioning holes in the shafts over locating pins in the fixture. The six holding screws then are tightened, holding the shafts in the centering vees. The two locking arms *H* are raised with the projecting stud entering the slots at the ends of parts *E*. These arms are so made that when in use the bottom of *E* is perfectly square with base *A*. Two wing nuts are used to hold down straps *E*. The six shafts are then ready to be ground.

When the first side of each tongue has been finished, locking arms *H* are loosened movable center *B* is rotated 180 deg., after which the locking arms *H* are again swung into position and tightened. The other side of the tongue on each shaft can then be ground.

A fixture similar to the one described is now being used to mill the shaft tongues. *Suggested by James Gibson, Wright Aeronautical Corporation.*



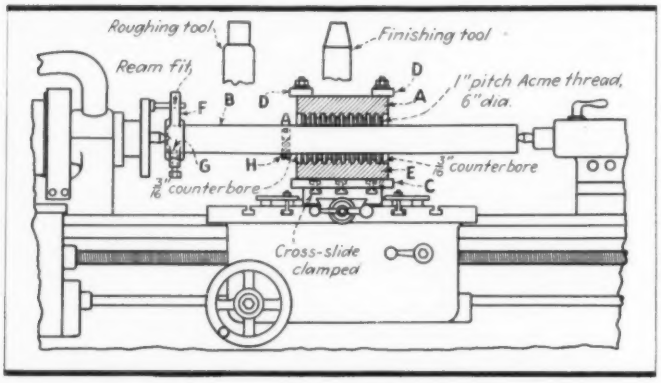
IDEAS FROM PRACTICAL MEN

Lathe Set-Up for Threading Leadscrew Nuts

BY ARTHUR SILVESTER

When a British concern decided to build gun-boring lathes in its own plant, six halfnuts for the leadscrew with Acme threads of 1-in. pitch had to be machined from three bronze castings *A*. The castings were bored and threaded by using a boring bar *B* mounted between centers.

A 12x12-in. cast-iron plate *C* was machined on both sides to a thickness of $1\frac{1}{2}$ in. and bolted as shown to the lathe carriage. When the bronze casting, first machined all over, was bolted to plate *C* by straps *D* and studs *E*, the center of the hole to be bored and



This lathe set-up was used for boring and threading halfnuts for a large gun-boring lathe. The arbor and cross-slide were fixed in position for the work

threaded coincided with the center line of the lathe spindle. After setting up the work, the arbor with dog *F* was mounted between the centers and the casting was set true for boring. The arbor was recessed at *G* for the setscrew to prevent the arbor from moving, which, if it occurred during machining would obviously spoil the thread. With the cross-slide leadscrew removed, the slide was clamped in position to prevent movement in any direction.

The hole in the casting was then bored to the minor diameter of the thread, and counterbored $\frac{3}{16}$ in. deep at each end to a diameter of 6 in., the major diameter of the thread. The lathe gears were then changed for threading the piece.

The thread was first roughed out with a square-nosed tool, removing 0.015 in. of metal per cut. Finishing was done with a tool shaped to conform to the Acme thread.

Since the lathe was not fitted with reverse drive, the tool had to be removed after each pass. After reversing the carriage by hand, the tool was reset with the aid of setscrew *H* and a depth gage. A section of the leadscrew on which these halfnuts were eventually to be used was prepared as a gage in checking the accuracy of the work. After boring and threading, the castings were cut in two, producing the six halfnuts required.

Gage for Locomotive Eccentric Cranks

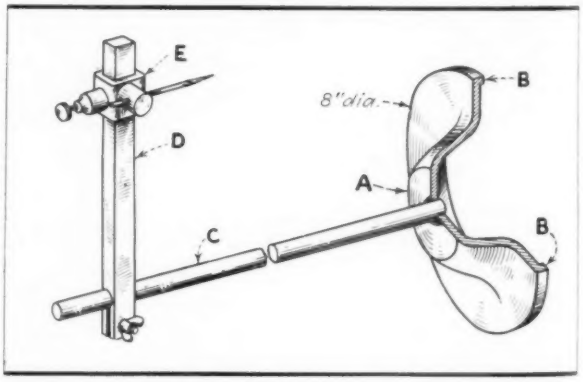
BY H. W. STOWELL

When setting locomotive eccentric cranks for a specific throw, most locomotive shops use a gage similar to the one illustrated, but unusually provided with a ball center backed up by a coil spring to locate the base of the gage in the axle center. Such gages enable the machine shop to deliver wheels to the erecting floor with the cranks reamed and bolts fitted.

Making one of these gages is a troublesome toolroom job, and usually requires several special forgings and equipment for spherical turning. This is not the case for the illustrated gage. It can be made chiefly from scrap material found in locomotive shops.

Base *A* is a bell-type side-rod collar counterbored on the outside, leaving a small bearing at *B*. Stem *C* is a length of 1-in. steel tubing, while arm *D* is a length of rectangular wood provided with trammel point *E*. A hole is drilled through arm *D* to provide a sliding fit on stem *C*. A wing nut and bolt takes up wear at this fit.

To use the device, a circle the same diameter as the outside of base *A* is drawn central on the end of the main axle. Tram point *E* is adjusted so that the distance from the center of stem *C* to the tram point is equal to one-half the specified throw of the crank. One man holds the gage central with the circle on the axle, while another holds the gage square and adjusts the eccentric crank for the throw set by the tram.



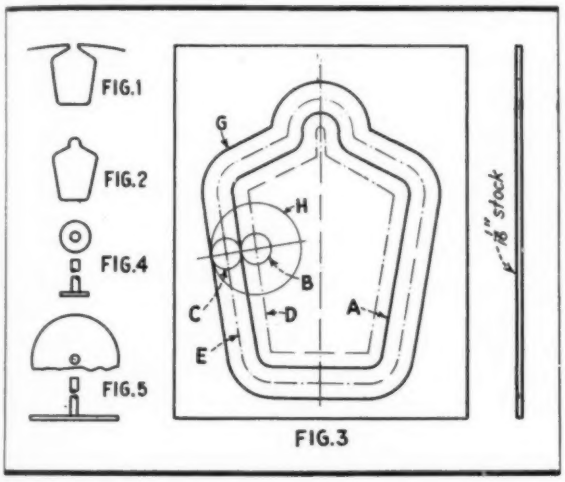
This gage for setting locomotive eccentric cranks can be made from a side-rod collar and 1-in. tubing, and does not require a ball center backed up by a coil spring to locate it in the axle center

One Templet for Engraving Punches and Dies

BY NELSON HALL

At one time we had a group of armature punches and dies to make for a new line of motors, and it was decided to route them with a Gorton engraving machine. This machine uses a templet several times the size of the work. A stylus follows the templet and guides the cutter in the work through a pantograph. With suitable templets, a great variety of work can be handled.

For punch and die work it was found necessary to have only one templet for both the punch and die; however, one stylus for the punch and another for the die were required.



When making punches and dies for armature stampings, the work can be done with one templet on an engraving machine, but using a stylus for the punch and a second stylus for the die

In starting the layout for a job, one should pick, when possible, a cutter that will form the smallest radius of the job. After cutting a groove, its width can be used in laying out the stylus and templet.

Fig. 1 shows one of the armature slots—the remaining slots are obtained by indexing. Fig. 2 shows the punch contour. Radii in the corners are necessary if the job is to be made without hand work. Many times the engineering department prefers these to corners, and if there is a suitable understanding between the engineering and production departments, provision can be made for stock cutters.

In Fig. 3, line *A* is Fig. 2 enlarged four times. Usually it is best to lay out this line as large as possible. As line *A* is the outside of the punch and the inside of the die, it is the base line for both. Circle *B* is the diameter of the cutter enlarged four times; when it is cutting the die, its center is traveling on line *D*. Circle *C* is four times the cutter diameter, and when it is cutting the punch, its center travels on line *E*.

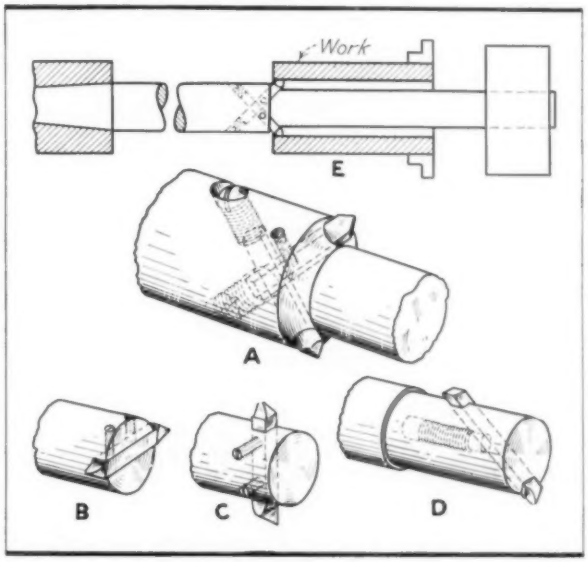
The distance between lines *D* and *E* is the cutter diameter increased four times. The distance between lines *G* and *A* is always equal to the diameter of circle *C*: therefore, if the contour bounded by line *G* is cut from $\frac{1}{16}$-in. stock and a stylus as shown in Fig. 4 runs inside of this templet, Fig. 2 will be generated by the cutter on the work. With another stylus $1\frac{1}{2}$ times the diameter of *C*, such as *H* in Fig. 3 and made as shown in Fig. 5, the cutter will generate Fig. 1 on the work when this large stylus runs in the templet on line *G*. When the templets are made, it is best to cut samples in soft steel with the punch stylus and the die stylus, and try them together. In this way, errors can be detected and stock for clearance or finishing can be checked before the real work is started. In armature work, it is usually best to leave the punch large so that the die can be finished and hardened, after which the punch can be sheared into it for a perfect fit; this is necessary when stamping thin stock, because it will eliminate burrs on the stamping.

For stamping thick stock, clearance must be provided between the punch and die. If circle *C* is made small, the punch will be cut oversize; if *C* is made large, the punch will be undersize. Hence by trial with the one stylus, the desired results can be obtained without disturbing the die. This method for engraving punches and dies has proved to be quite correct, and at the same time a flexible layout for the class of work involved.

Two-Tool Boring Bars

BY S. ARTHUR

The advantages claimed for the two-tool boring bar *A*, described by R. H. Weller (*AM*—Vol. 86, p. 1232) can be questioned unless it is used on production jobs. It would not be economical for toolroom use as advocated by the author, because of the lack of suitable work. For most jobs, it has no advantage over the boring bars *B*, *C* and *D*, which are designed for toolholders and are in general use. When



Boring bar *A* has few advantages not found in bars *B*, *C* and *D*. When cutting from two sides of the bore, it is advisable to support the boring bar in a guide bushing

it is necessary to cut from two sides of the bore, Bars *B* and *C* would be equally suitable to Mr. Weller's design.

If the bar were made as described by Mr. Weller, that is, by setting it between centers and grinding the toolbits to size for the required bore, the bar would have to be supported as shown at *E* in the drawing. Otherwise it would spring and the tools would cut the bore larger than desired. It is common turret lathe practice to support such bars by using a guide bushing in the headstock.

Stopping Chatter on Long Work

BY RALPH R. WAECH

When long work is held by an overhanging follower rest, a simple way to prevent chatter is to take up the underplay between the rest and the work with a block of soft wood. The wood is placed on the carriage and can be kept snug against the work by two wedges between the carriage and the work.

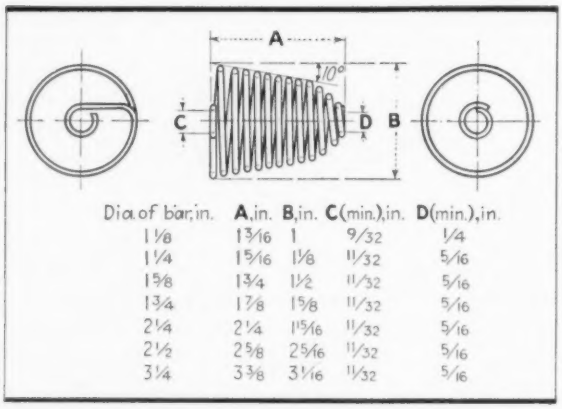
These wedges tend to tip the wood in a direction opposite to the follower rollers. The block is carried along at the feed of the machine, which avoids binding.

Safety Device for Turret Lathes

BY R. BUCKLEY

In 1936, Alfred Herbert Ltd., Coventry, England, patented a safety device intended to prevent turret lathe operators from trapping their fingers between the end of the overhead support bar and the bushing on the turret toolholder. Such an accident is liable to occur when the operator rests his hand on the support bar or the bushing while the automatic feed is engaged.

The device originally consisted of rubber sleeves attached to the toolholders or a rubber buffer fastened to the end of the support bar. Because of the shortage of rubber it became necessary to find a substitute.



Dia. of bar, in.	A, in.	B, in.	C (min.), in.	D (min.), in.
1 1/8	1 3/16	1	9/32	1/4
1 1/4	1 5/16	1 1/8	11/32	5/16
1 5/8	1 3/4	1 1/2	11/32	5/16
1 3/4	1 7/8	1 5/8	11/32	5/16
2 1/4	2 1/4	1 15/16	11/32	5/16
2 1/2	2 5/8	2 5/16	11/32	5/16
3 1/4	3 3/8	3 1/16	11/32	5/16

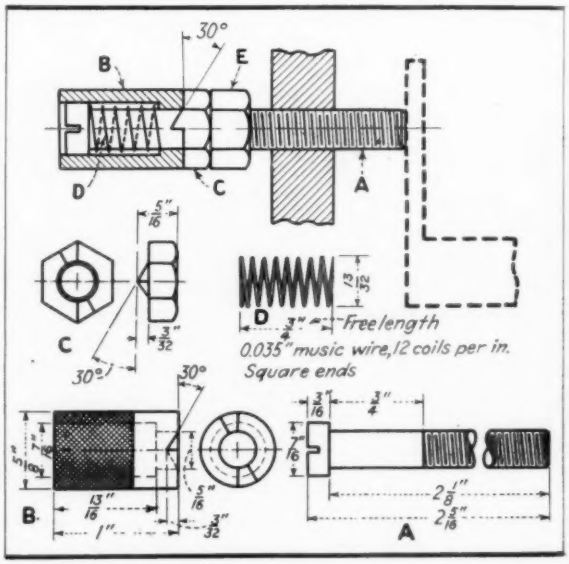
This spring buffer for overhead support bars on turret lathes is intended to prevent machinists from trapping their fingers between the overhead support bar and the bushing on the turret holder

After experiments, it was found that a conical spring, as shown in the drawing, was equally effective. In the general interest of safety, Alfred Herbert Ltd. has given permission for anyone to use this device.

Pressure Regulating Screws for Clamping Work

BY EDWARD LAY

Jigs and fixtures for machining frail castings used in aircraft instruments and similar products need certain features to prevent damage to or misalignment of the castings. This is especially true today when many machine operators do not have the skill of expert machinists. For example, we found that it was necessary when setting up one light casting in a fixture to use a supporting stop screw that prevents the operator from exerting too much pressure on the part. The design employed is shown in the drawing. This screw acts like an ordinary one until it contacts the casting and a predetermined pressure is applied. Then, regardless of the "feel" of the operator, the screw cannot be tightened further, thereby preventing damage to the casting.



When setting up frail castings in jigs or fixtures, excessive clamping pressure can be avoided by using a pressure regulated clamping screw, thereby preventing damage to the casting

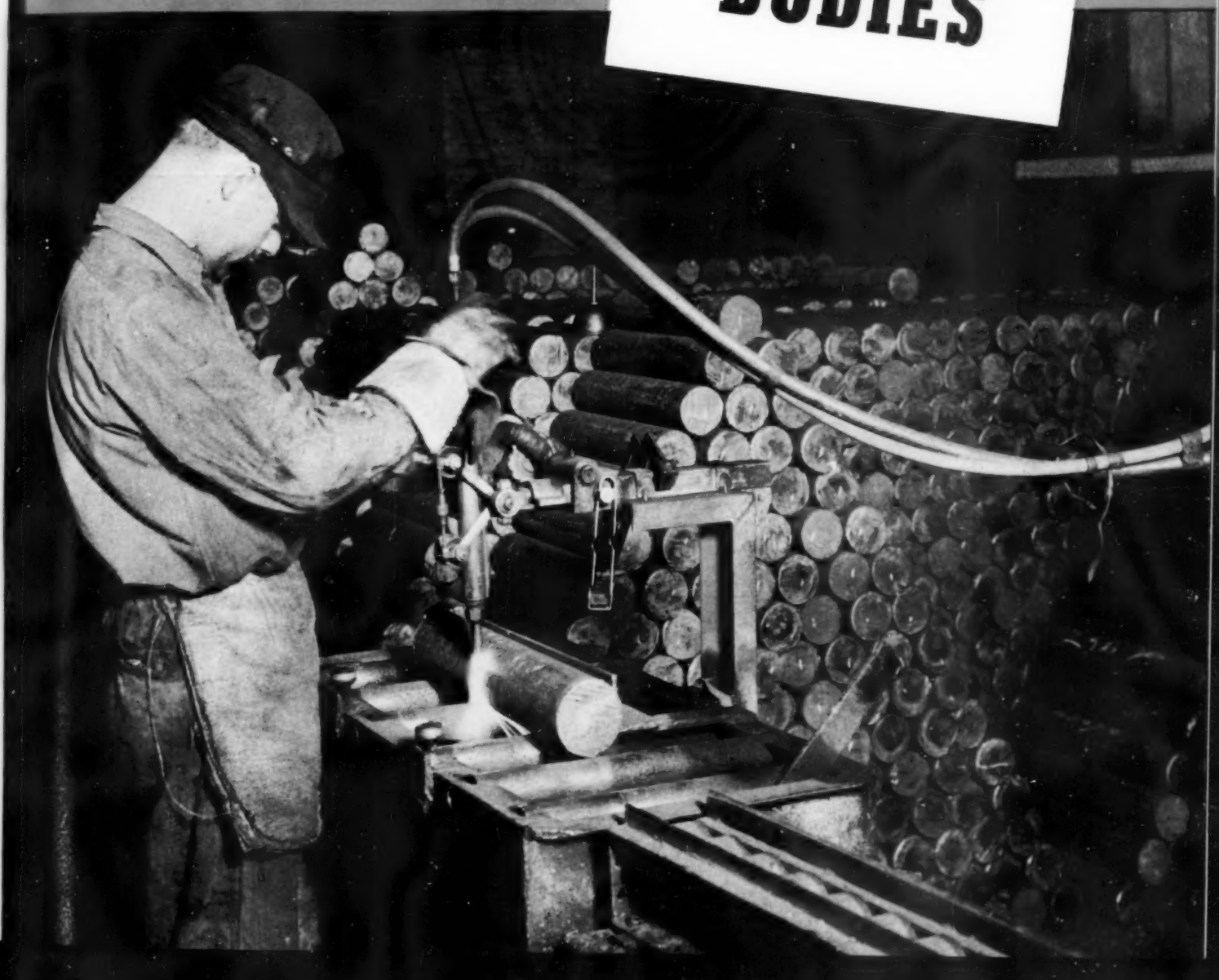
Screw *A* is run against the casting by turning knurled slip bushing *B*. After contact is made and the predetermined pressure is applied, slip-bushing *B* turns against nut *C* compressing spring *D*, thereby causing the bushing to rise on the beveled shoulders of the nut. When the bushing has turned 180 deg., it drops back to its original position on the nut. Additional turning repeats this action without increasing the screw pressure on the casting. Lock nut *E* is used to regulate spring compression and determine the screw pressure against the casting.

Armament

SECTION OF AMERICAN MACHINIST

FORGING 75- and 90-mm. SHELL BODIES

Rejects are held below 0.5 percent of total production by close inspection during forging and by adjustable water-cooled dies that control concentricity and wall thickness of the shell bodies



Forging 75mm. and 90mm. Shell Bodies

A MANUFACTURER of railway rolling stock in the Pittsburgh district is producing 75-mm. and 90-mm. high-explosive shell forgings, using Hydraulic Press Manufacturing Company Fastraverse and Baldwin-Omes presses. The HPM presses are set up in pairs, one press for piercing the hot billets, and the other for drawing them to the proper length and section. Piercing and drawing are combined in the Baldwin-Omes press, the mandrels for the two operations running off the same crankshaft. After the drawing operation, the shell forging is complete with inside finish bore requiring no internal machining, and with a minimum machining allowance on the outside.

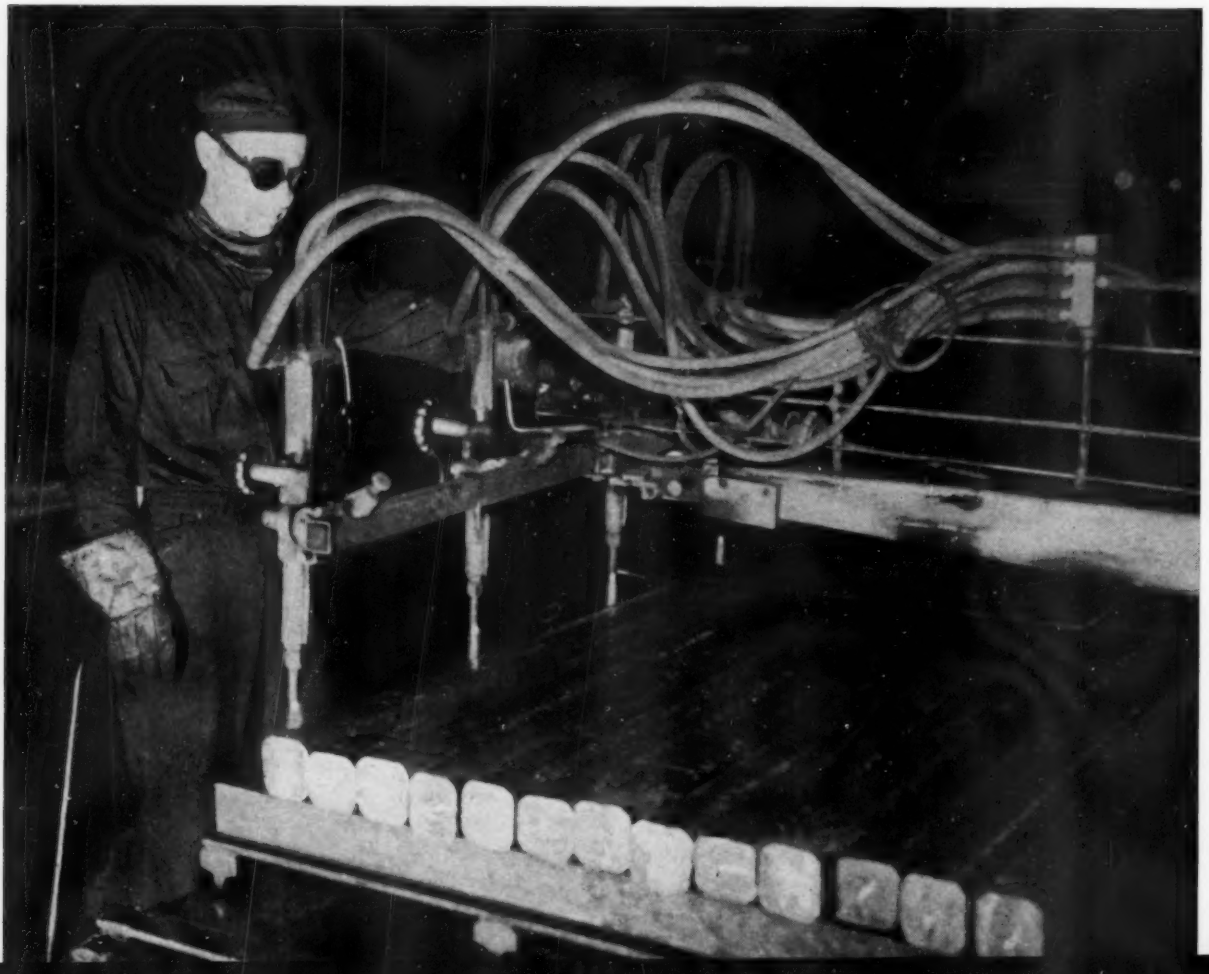
Mill-length bar stock for the forgings is moved from a storage yard by roller conveyor to tables where it is flame cut into double-billets. Each bar in passing from storage to the tables is inspected for surface defects which if existent and not too deep are removed with a chisel. Stock for the 90-mm. shell is round, while that for the 75's is square with radiused corners.

Thirteen square bars or ten round ones constitute one set-up on the table for flame cutting. Round bars are cut into the 20-in. lengths, while the cut lengths of the square bars is $16\frac{1}{4}$ in. All are later nicked by an oxyacetylene torch. The nicked point provides a starting point for a break which is completed under a mechanical press. Such breaking is mandatory, since each billet must have one end so exposed that piping seams or other flaws can be detected; should the billet be flame cut at both ends, such flaws if existent would be covered with slag and would not be discovered until some point in later forging operations.

Gravity conveyors are used to pass the billets from the cutting table to the flame notcher, to the breaking press, then to inspectors, and finally to the loading stations of Tate Jones gas-fired rotary-hearth furnaces. Furnace heat is maintained by automatic temperature controls that regulate gas-mixing valves. The furnaces are also equipped with thermostatically controlled oil-burning equipment which functions immediately should the gas supply fail.

Each furnace has refractory brick fire walls and a revolving hearth of 4-in. deep Babcock & Wilcox plastic chrome ore. When this hearth is laid originally it is heated for six hours at 2,600 F. to a boiling condition. Boiling ceases when the temperature is lowered

Stock for shell forgings is flame cut from mill-length bars. After trimming the ends, four torches are set to cut 40 double-length billets in one pass over the rack. The square bars shown here are for 75-mm. shell forgings. Round bars are used for the 90-mm. shell



The nicked double-length billets are broken into two 10-in. sections in this press. Inspection requirements demand that the billets be broken so that piping seams and other flaws can be detected before heating to forging temperature. One clean end also eliminates the possibility of slag entering the forged cavity and producing a defective shell

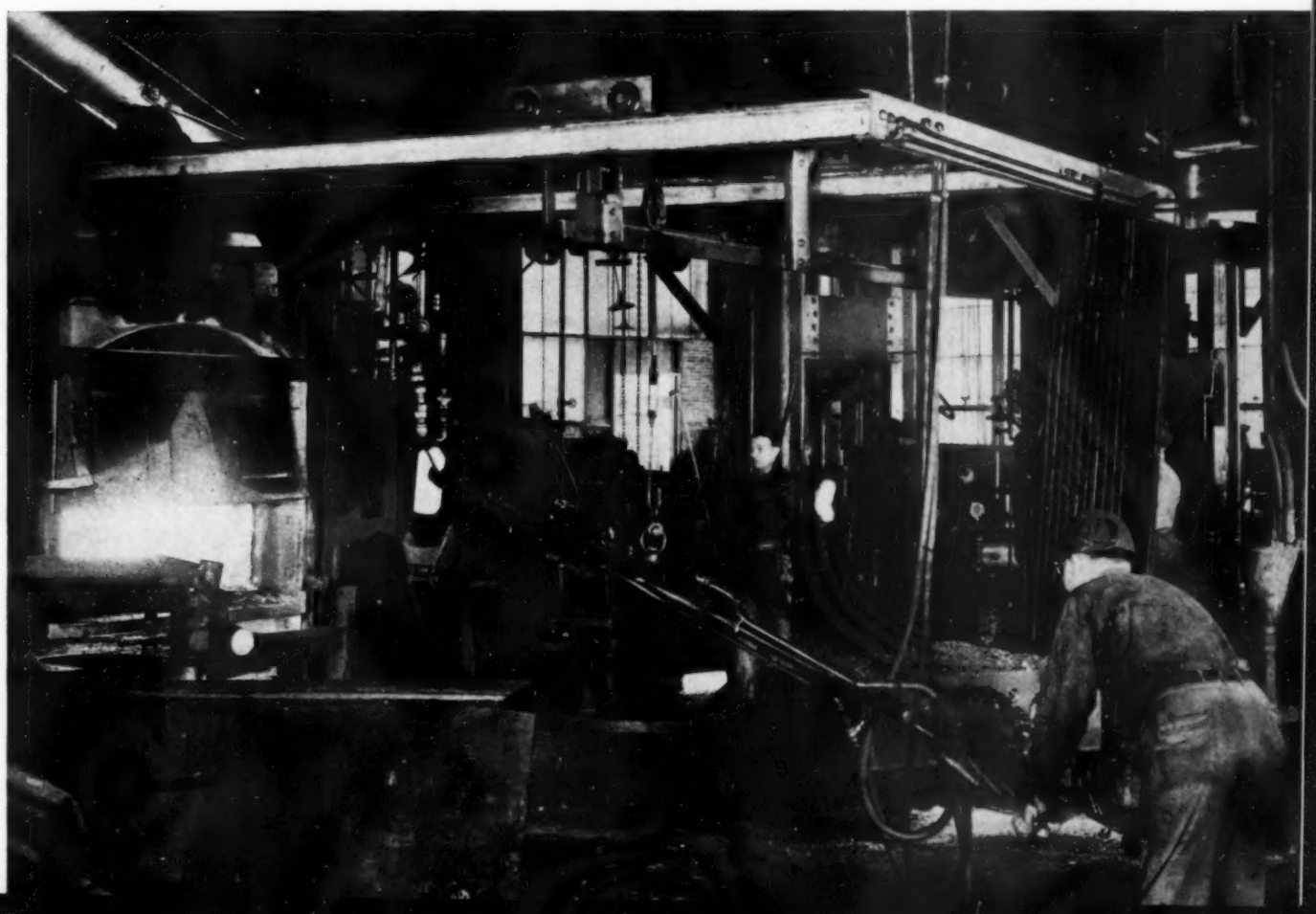
to 2,370 F.—the furnace operating heat—and the plastic ore forms a hard glazed surface that under full load and constant operation has a service life of six to ten months. Billets are charged upright and spaced 1 to 2 in. apart on the hearth. Maximum capacity of each furnace is 400 billets, which remain in the furnace one hour and 50 min. to attain the required forging temperature of 2,230 F.

All furnaces, except the one installed originally for an educational order of shell forgings, are charged and unloaded through a single door with pneumatically operated water-cooled tongs; the original furnace is charged and unloaded through separate doors by two furnace attendants. Hot billets removed from the furnaces are tumbled between motor-driven corrugated rollers to remove scale, and then are lifted by tongs to the forging presses.

The heated billet is first placed in the die of the HPM Fastraverse piercing press, which is equipped with a hydraulic ejector actuated by a small ram located below the surface of the press bed. The ram acts as a cushion and holds the ejector approximately 1 in. above the bottom of the die. This supports the hot billet so that a centering ring, which fits into the inside bore of the die and is set in place manually by an operator, can be fitted over the top of the billet. This ring serves two purposes: (1) to center the billet in

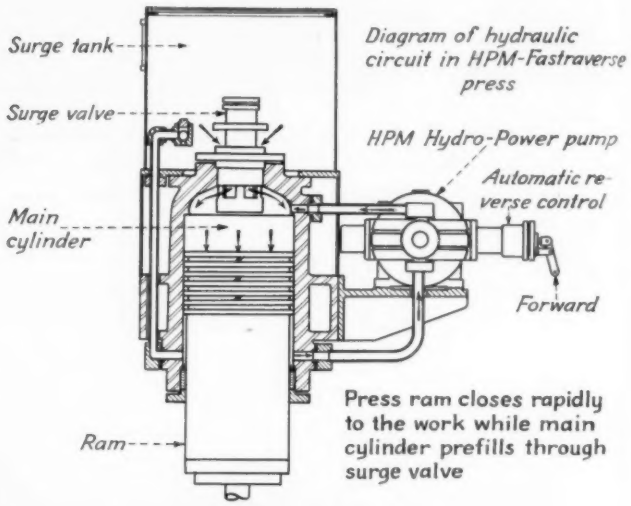
Billets are heated in Tate Jones rotary-hearth furnaces fired by gas. They are charged and unloaded through a single door by pneumatic water-cooled tongs. Furnace capacity is 400 billets, which are heated to the forging temperatures of 2,230 F. in one hour and 50 minutes

Courtesy of Hydraulic Press Manufacturing Company



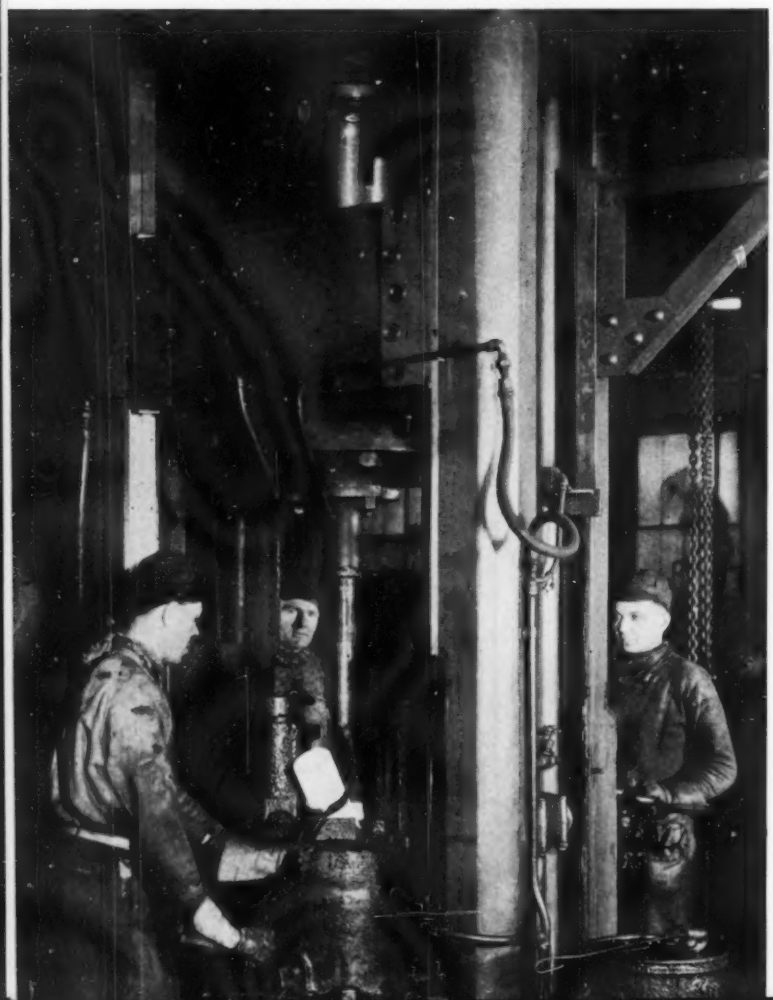
In the first operation on the HPM Fastraverse presses, the heated billet is placed in the piercing die and centered by a ring that fits into the die. The ring guides the punch into the billet, insuring a concentric forging of uniform wall thickness

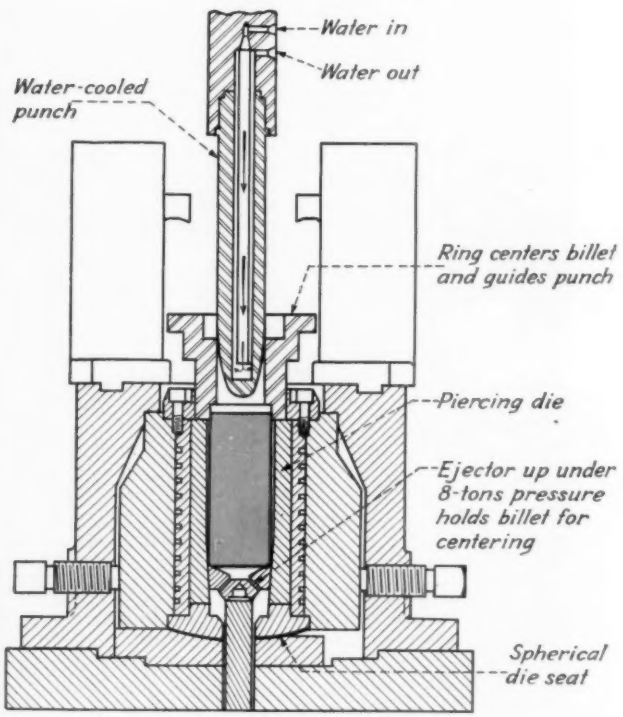
In the HPM Piercing Press, the billet is first centered to insure concentricity and uniform wall thickness of the forging. The billet is held above the top of the die under 8 tons pressure by the ejector. After centering, the pressure builds up to first seat the ejector and then pierce the billet. Once the press is started, its operation is automatic through the cycle illustrated by these drawings



After piercing, the billet is automatically ejected. The centering ring is removed manually, and the pierced forging is transferred by tongs to the bottoming die on the drawing press. Should the centering ring and billet adhere to the punch they are stripped when the ring hits lugs on the guide posts

Courtesy of Hydraulic Press Manufacturing Company





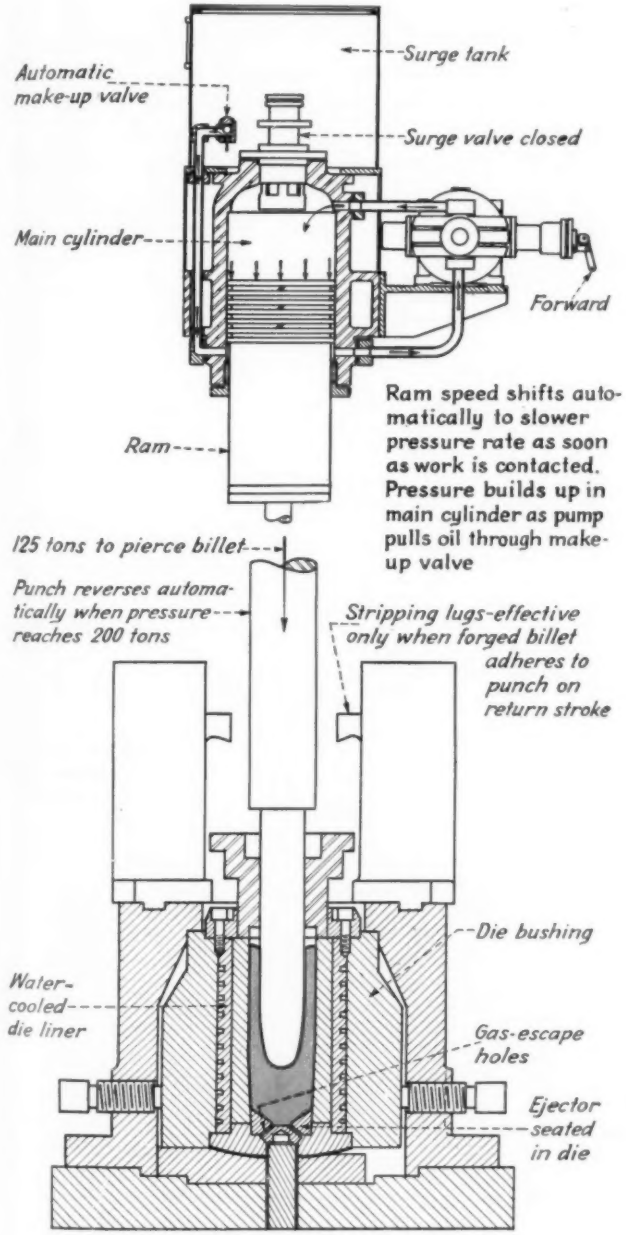
BILLET CENTERED FOR PIERCING

the die, and (2) to guide the punch during the piercing operation.

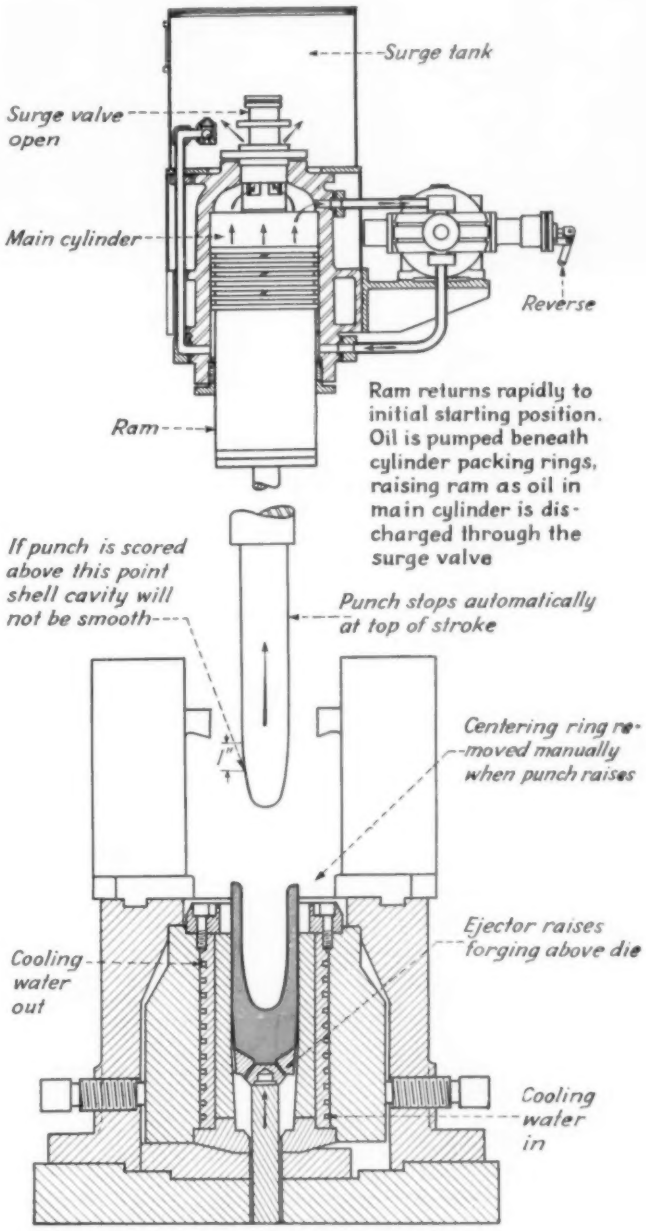
The uniformity of wall thickness or concentricity of the shell forging depends upon the accuracy of this piercing operation, since only minor corrections can be made during the subsequent drawing operation. To assure concentricity, the die is set on a spherical seat so that it can be moved slightly in any direction by means of setscrews to maintain punch alignment.

The press cycle is semi-automatic and is started when the press operator depresses two electric push-buttons. The action of the press during the cycle is shown in the drawings below. A pressure of 125 tons is required to pierce the billet and form the exterior of the closed end, including a small projection so that the forging can be centered conveniently for machining operations.

During the upward movement of the piercing punch, the pierced billet and centering ring is p shed up by the hydraulic ejector. Should the forging adhere to the punch, which usually happens when the punch is new, the billet is stripped from the punch when the centering ring hits lugs on the ring guide posts. One operator removes the centering ring, while another transfers the pierced billet with tongs to a table between the piercing and drawing presses. The temper-


Automatic make-up valve
Surge tank
Surge valve closed
Main cylinder
Forward
Ram
Ram speed shifts automatically to slower pressure rate as soon as work is contacted. Pressure builds up in main cylinder as pump pulls oil through make-up valve
125 tons to pierce billet
Punch reverses automatically when pressure reaches 200 tons
Stripping lugs-effective only when forged billet adheres to punch on return stroke
Die bushing
Water-cooled die liner
Gas-escape holes
Ejector seated in die

BILLET PIERCED


Surge tank
Surge valve open
Main cylinder
Reverse
Ram
Ram returns rapidly to initial starting position. Oil is pumped beneath cylinder packing rings, raising ram as oil in main cylinder is discharged through the surge valve
If punch is scored above this point shell cavity will not be smooth
Punch stops automatically at top of stroke
Centering ring removed manually when punch raises
Ejector raises forging above die
Cooling water out
Cooling water in

BILLET EJECTED

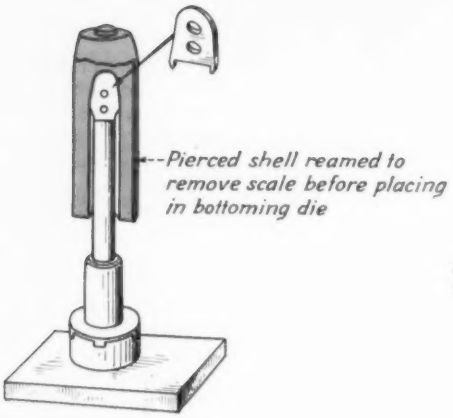
Courtesy of Hydraulic Press Manufacturing Company

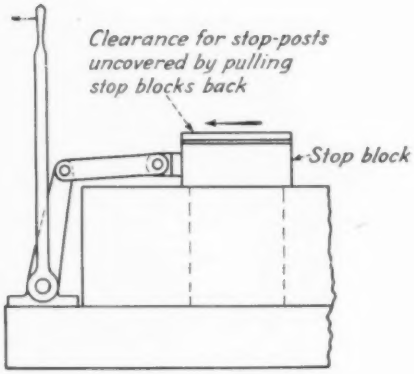
ature of the shell at this point in the cycle is 1,970 F.

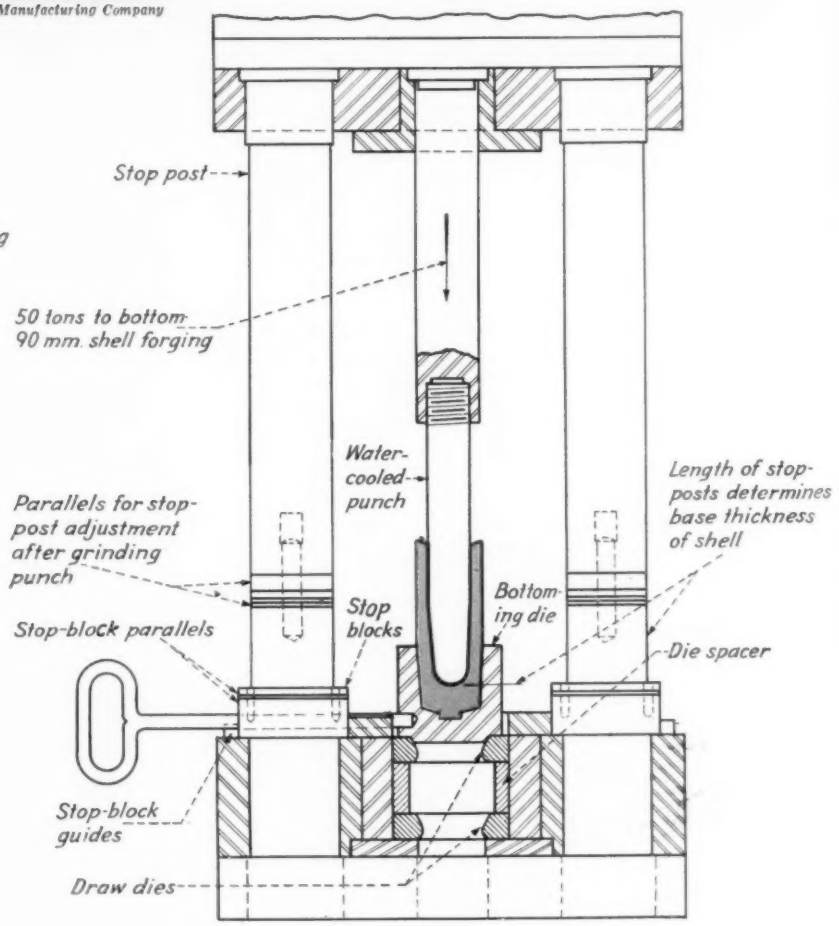
Should there be an accumulation of scale at the bottom of the pierced hole, the shell cavity is apt to be defective following the drawing operation. Furthermore, the drawing punch is liable to be scored. To prevent this, the pierced billet is reamed with a two-lipped tool mounted on a vertical spindle and operated by compressed air. This tool, shown in the drawing below, is shaped to conform to the contour of the pierced hole.

The pierced billet is then bottomed and drawn. Both operations being done in a HPM Fastraverse drawing press. One of the helpers on the press places a bottoming die directly on top of the draw rings,

Before drawing the shell to final length, the end of the pierced forging must be formed properly and the metal around the punch chilled to prevent the punch from pushing through the closed end. This is done in a bottoming die, placed manually on top of the draw ring. Stops under the ram guide post limit the punch travel during this operation





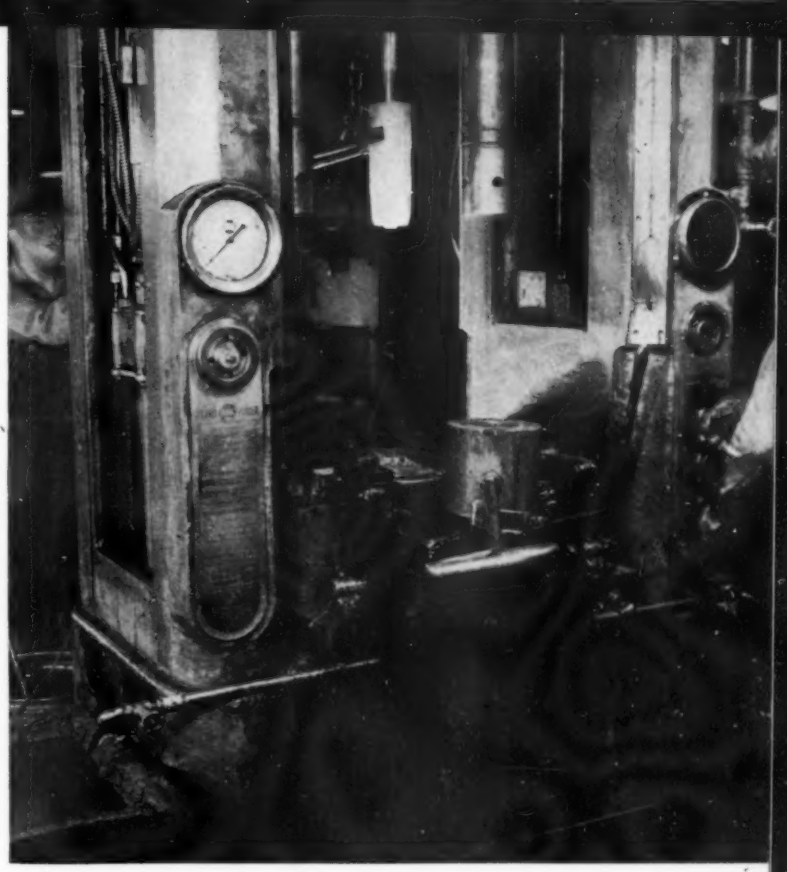


SHELL BOTTOMED IN DRAWING PRESS

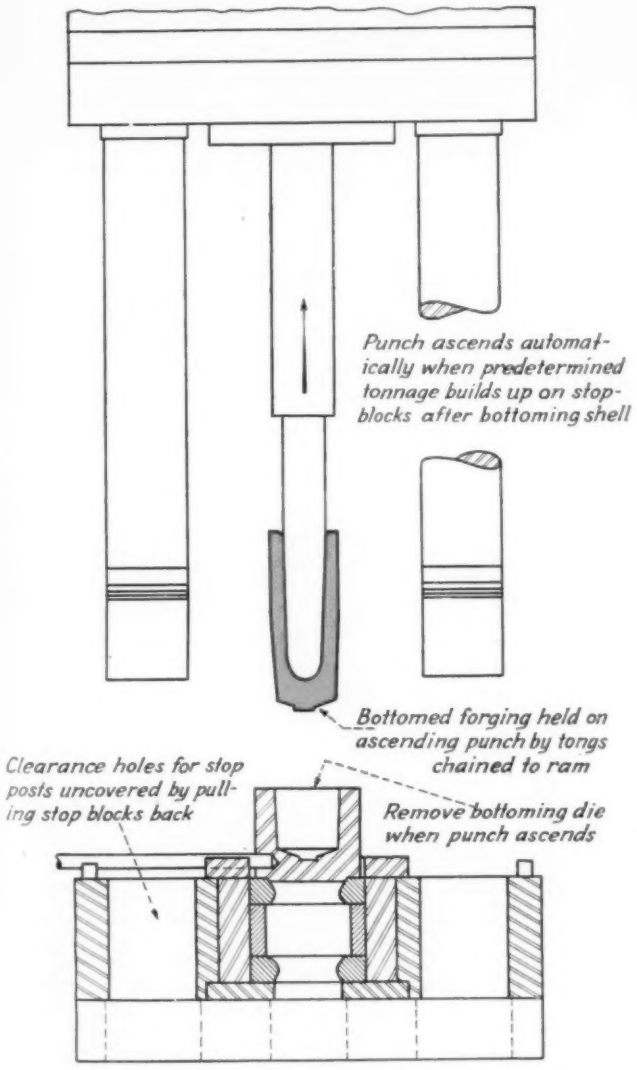
Before drawing the shell to final length and section, the pierced forging is reamed to remove scale from the cavity and is then placed in a bottoming die to form the base to its correct thickness and contour. This also chills the metal at the base to prevent the punch from pushing through the forging during the

while another helper sets the pierced billet in the die. The semi-automatic press cycle is started by depressing two pushbuttons. The advancing punch enters the pierced opening in the billet, forcing it into the die, thereby (1) forging the billet to the correct thickness between the inside cavity and the end of the shell, (2) closing the metal around the tip of the punch and chilling the metal so the punch will not push through the closed end during the drawing operation, and (3) tapering the closed end of the billet so that it will enter the draw rings easily. The travel of the punch is limited by two vertical stop posts which strike square stop blocks on the die block. The length of the two vertical stop posts can be adjusted to take care of any shortening of the punch by regrinding.

After bottoming, the press reverses as soon as a predetermined pressure (50 tons on the 90-mm. shell forging) is built up on the two die stop blocks. When

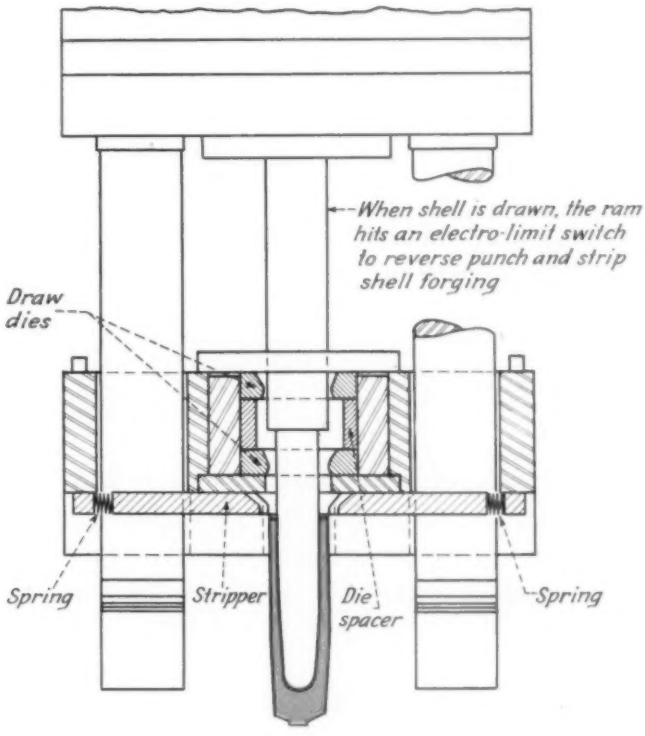


After bottoming, the forging is held on the ascending punch by tongs chained to the ram; simultaneously, the bottoming die is removed, and the square stop blocks are pulled back to uncover holes in the die block for the stop posts. On the downstroke the unchilled metal is ironed around the punch as it passes through the draw rings. The travel of the punch is set by a limit switch


Punch ascends automatically when predetermined tonnage builds up on stop-blocks after bottoming shell
Bottomed forging held on ascending punch by tongs chained to ram
Clearance holes for stop posts uncovered by pulling stop blocks back
Remove bottoming die when punch ascends

REMOVE BOTTOMING DIE

drawing operation. The hydraulic circuits of the HPM Fastraverse press for these operations are semi-automatic and are similar to those shown for piercing the shell forging


When shell is drawn, the ram hits an electro-limit switch to reverse punch and strip shell forging
Draw dies
Spring
Stripper
Die spacer
Spring

DRAW AND STRIP SHELL

reversal starts, the press operator pulls a lever which slides the two die stop blocks forward, uncovering openings through which the vertical die stop posts travel during the drawing operation. At the same time, a helper on the opposite side of the press grips the billet with tongs, chained to the press slide, thereby keeping the billets intact with the punch during the upstroke. Another helper pulls the bottoming die clear of the press.

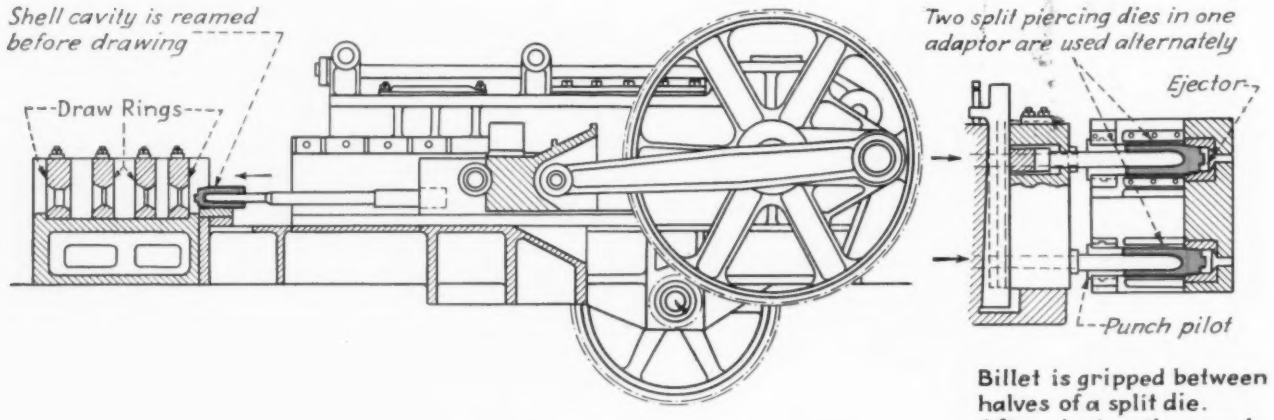
The punch then advances for the second time, forcing the pierced and bottomed billet through the draw rings. A pressure of 30 tons is required to draw the 90-mm. shell forging. When the billet has passed the last draw ring, spring-controlled stripper plates close above it. The press slide strikes an electric limit switch, which reverses the press. The upward action of the punch strips the forging from the punch, and it drops to a chute which carries it to a place of easy access. The temperature of the shell forging at this point is around 1,650 F.

In the original set-up for this drawing operation, three draw rings were used in the die, located one above the other with no space between them. This die arrangements was later changed, using two draw rings in the lower die with a spacer between them, as shown in one of the drawings. At the present time, a single draw ring is being used.

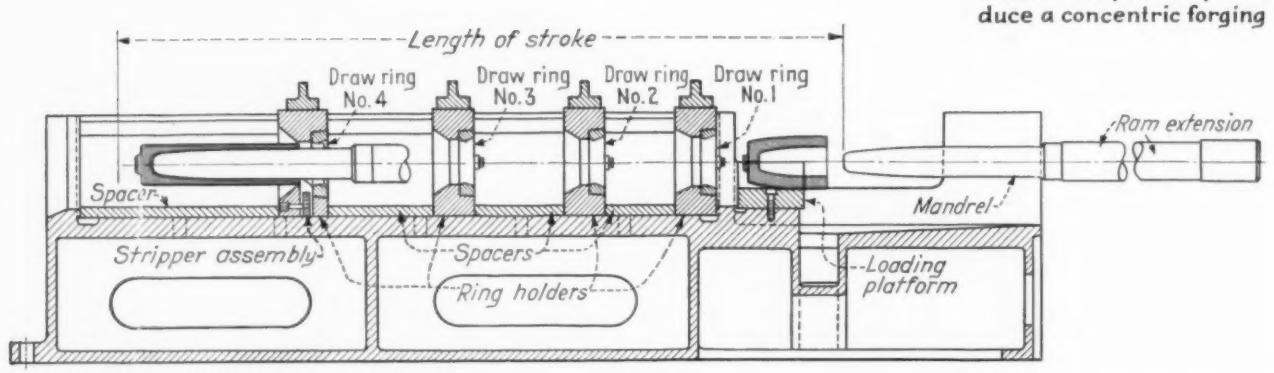
Rejections Less Than 0.5 Percent

Each completed forging is placed on a bench where it is checked for over-all length, cavity depth, and outside diameter. Every tenth forging is checked for concentricity by placing it on a vertical spindle where the weight of the forging accurately centers it on the mandrel. Here it is revolved. A roller connected to a dial indicator contacts the outer surface and indicates eccentricity or lack of uniformity in wall thickness. These two tests warn of any needed changes in punches or dies during the forging operation and long before the forgings are checked by government inspectors, thus avoiding any large number of rejects. Final rejections average less than 0.5 percent of total production.

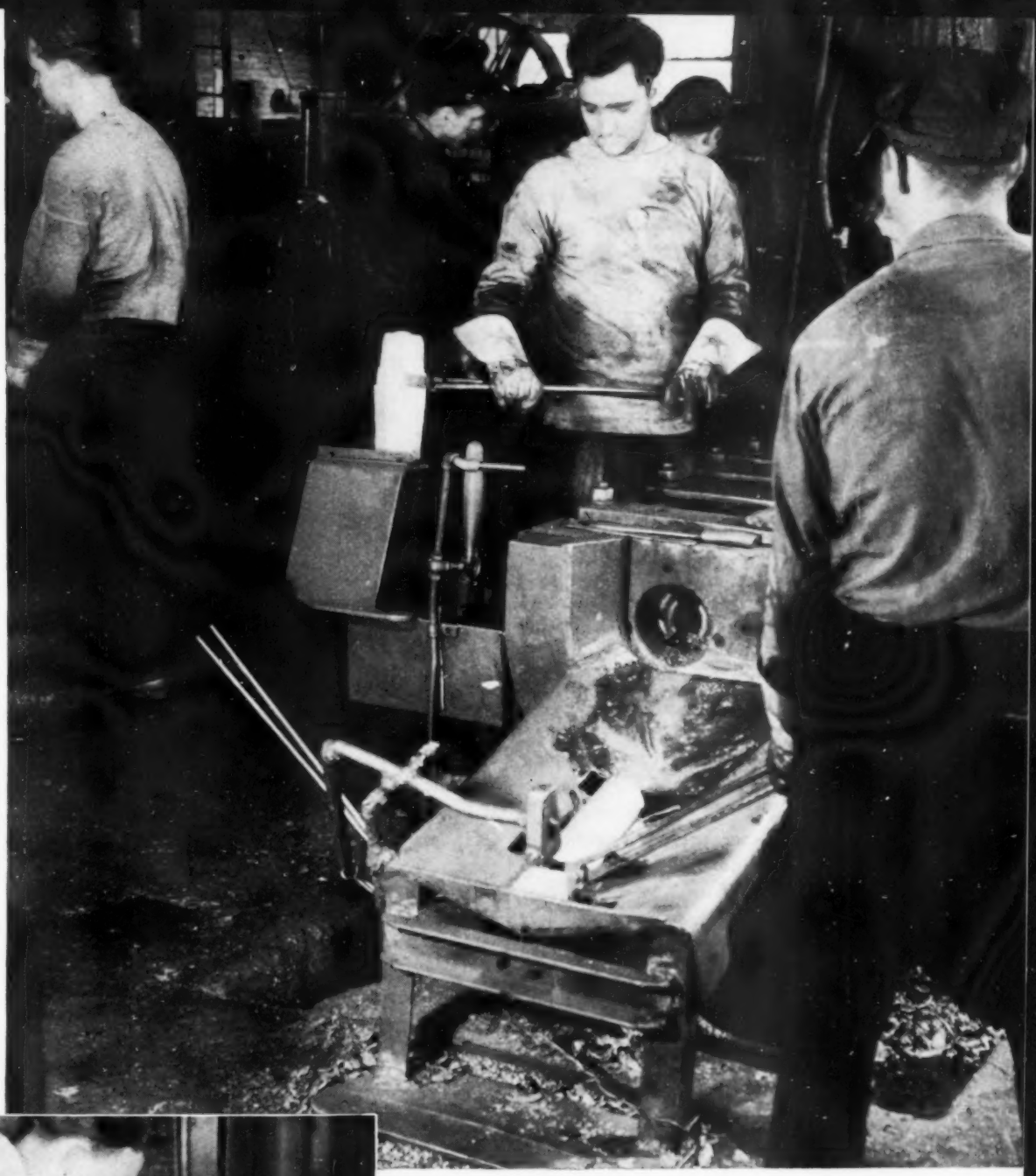
Punches, centering rings and punch guides are lubri-


Shell cavity is reamed before drawing
Draw Rings
Two split piercing dies in one adaptor are used alternately
Ejector
Punch pilot

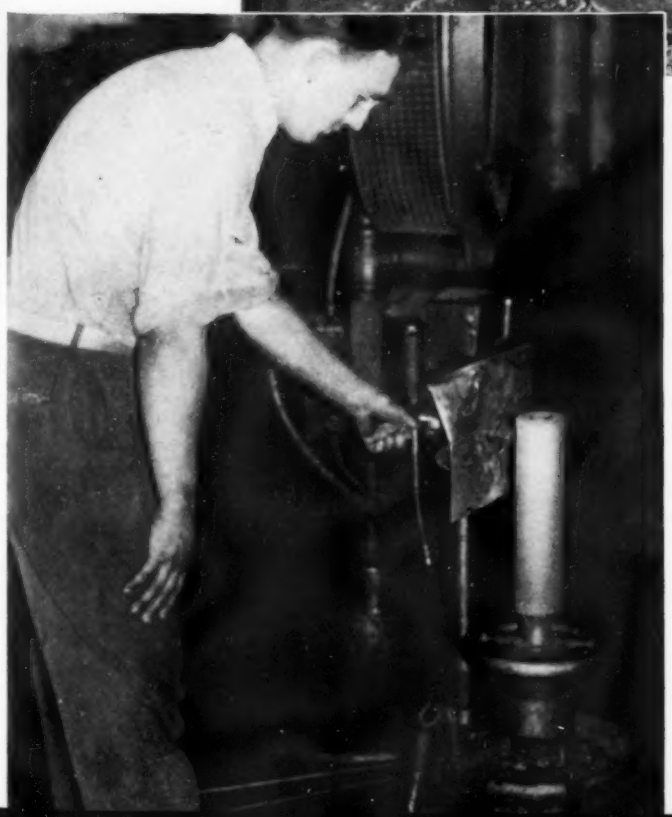
Billet is gripped between halves of a split die. After closing, the punch enters the pilot to produce a concentric forging



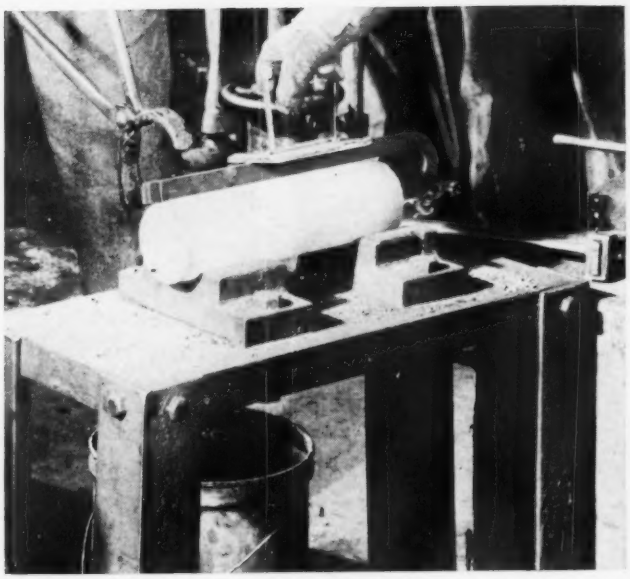
One of the shell lines for 75-mm. forgings employs a Baldwin-Omes press in which the piercing and drawing mandrels operate off the same crankshaft. Two piercing dies and mandrels are used to minimize wear. The draw rings are spaced along the bed of the machine so that the forging is passed all the way through one ring before it enters the next one. Latch-type strippers are mounted in the last ring



In the Baldwin-Omes press for forging 75-mm. shell, piercing and drawing are combined in the one machine. The mandrels for both operations run off a single crankshaft. All work is performed by one operator and four helpers

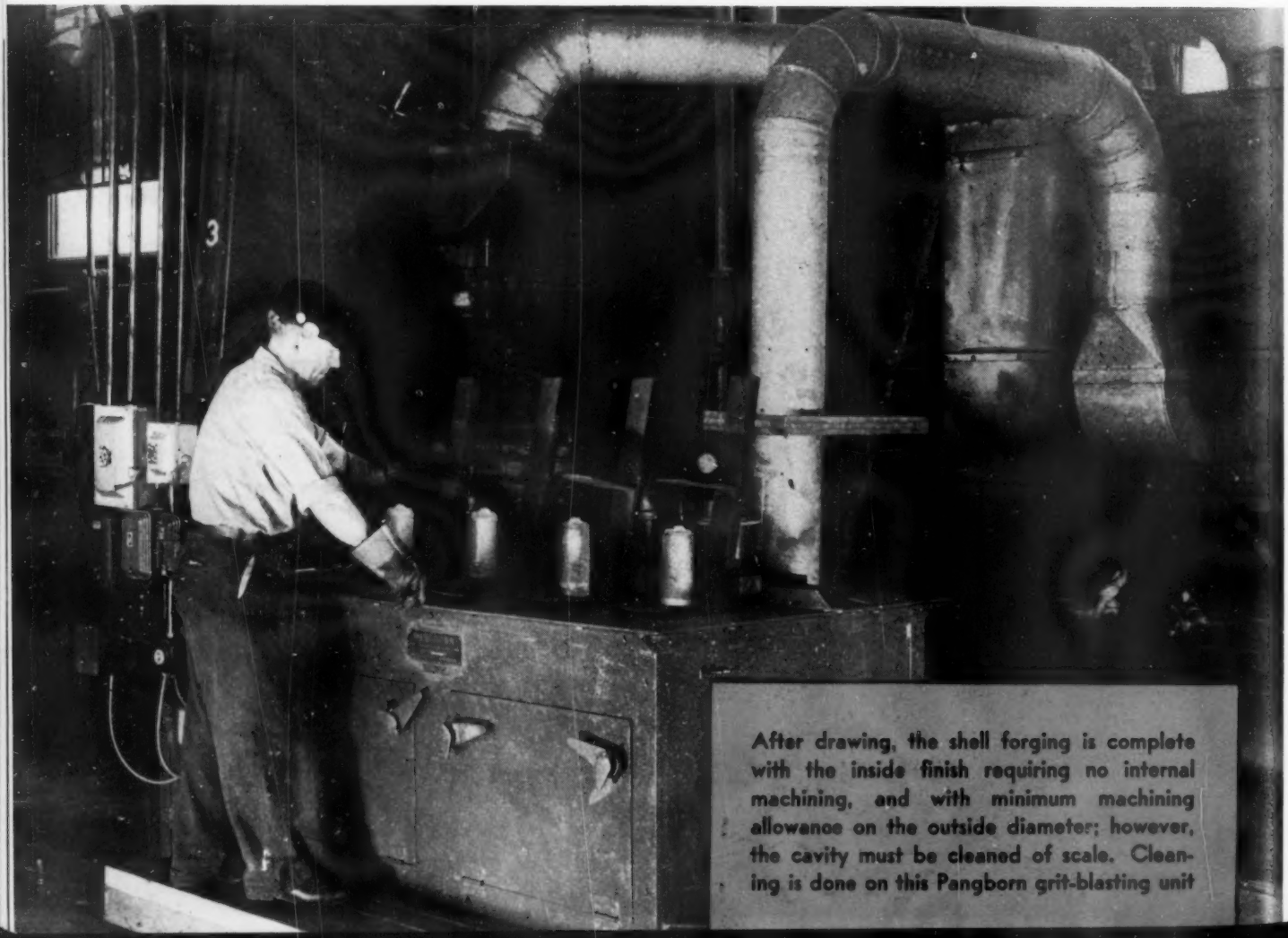


Every tenth shell is checked for concentricity by a dial indicator immediately after forging. The hot forging is placed over an expanding mandrel, is centered when the weight of the forging expands the mandrel jaws, and is rotated manually against the indicator spindle



Courtesy of Hydraulic Press Manufacturing Company

Each shell is checked for depth of cavity, overall length and outside diameter immediately after forging. Inaccuracies in the forging, indicated either by this or the concentricity check, are corrected by changing the punch or dies. Such early inspection is partly responsible for holding rejections to less than 0.5 percent of total production



After drawing, the shell forging is complete with the inside finish requiring no internal machining, and with minimum machining allowance on the outside diameter; however, the cavity must be cleaned of scale. Cleaning is done on this Pangborn grit-blasting unit

cated before each operation by swabbing with colloidal graphite. When required, the draw punches only are cooled between operations by immersing in a water-filled bucket lifted over the punch; however, most of the cooling is accomplished by circulating water internally through the punches. The dies are cooled by running water through passages built into the die liners.

When the punches and dies are new, greater tonnage is required for the first few operations until they acquire a hard smooth surface. Such tonnage can be reduced materially by using powdered coal thrown on the hot billets. Greater tonnage is often needed if the metal temperature is low—50 to 100F. difference in temperature makes considerable difference in the tonnage required.

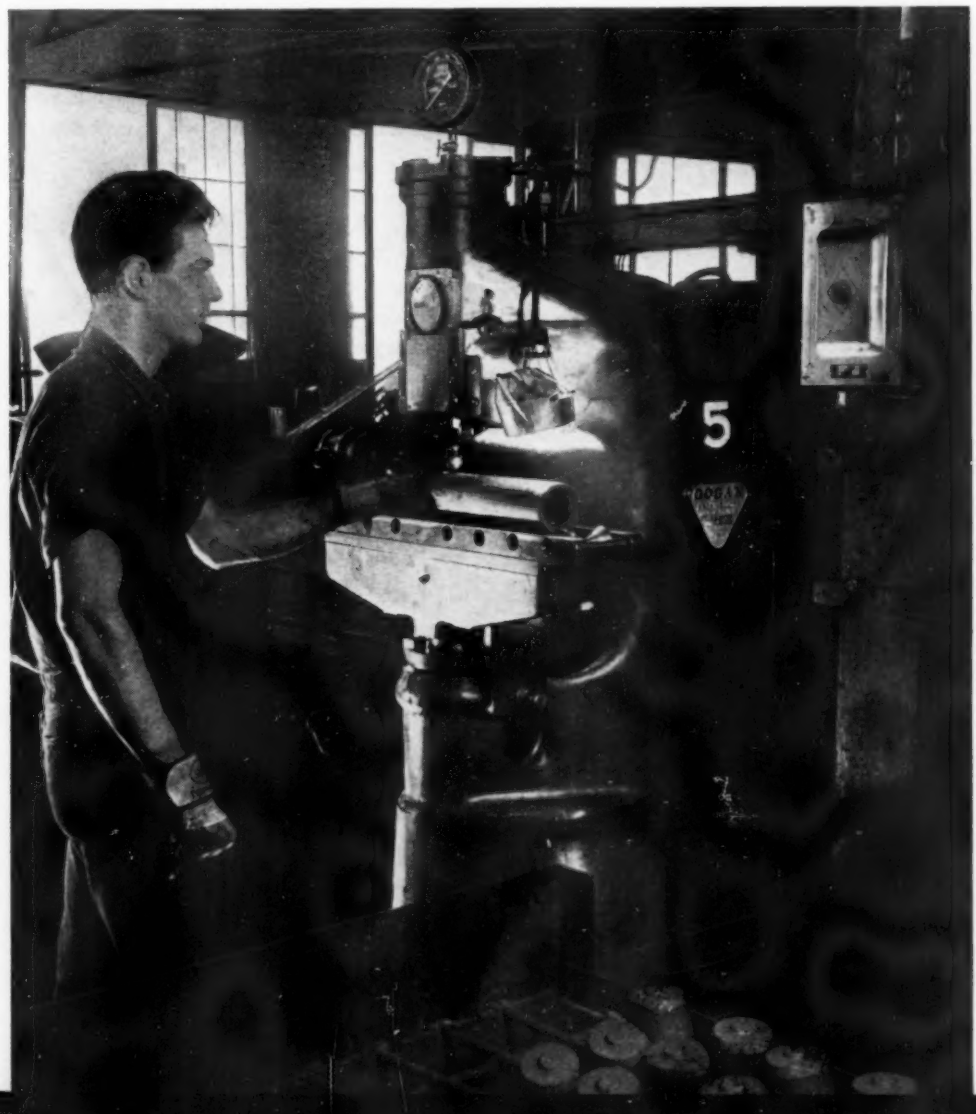
Thousands of shell forgings are produced daily on the HPM Fastraverse hydraulic presses.

Forging On Mechanical Presses

Heated billets from Tate Jones rotary-hearth furnaces are also fed to another shell-forging line which employs a Baldwin-Omes mechanical press. Piercing and drawing are combined in this press, the mandrels for these two operations running off the same crankshaft. In order to increase the capacity of the press, two sets of piercing mandrels, die liners and drawing mandrels were originally provided so that each piercing mandrel and drawing mandrel could be used in rotation. This gave the mandrels and dies time to cool, since they were used on alternate forgings, thereby reducing wear and increasing the life of the tools.

After de-scaling, a heated square billet is inserted into an open split die. This billet, being square, rests on the lower surface of the die, which is closed pneumatically by operating a pedal actuated air valve. After closing, a piercing mandrel operated from the crankshaft of the machine passes through a guide bushing and enters the hot square billet, expanding the metal toward the wall of the die. Since the closed die is circular, clamping the square billet rigidly in position, and the punch is centered accurately by the guide bushing, concentricity of the pierced forging is assured. After piercing, the die is opened pneumatically, and the pierced billet falls clear.

The press operator removes the billet and places it on a table adjacent to the drawing bench. Here again, as in the case of the hydraulic presses, the operator places the forging over a rotating two-lipped tool



Every forging is checked for hardness on Gogan testing units. This operation requires less than 20 sec. per shell. The forgings are taken from portable sand-pit trays, in which the shells are stored for six hours while cooling

which removes the scale from the bottom of the pierced hole.

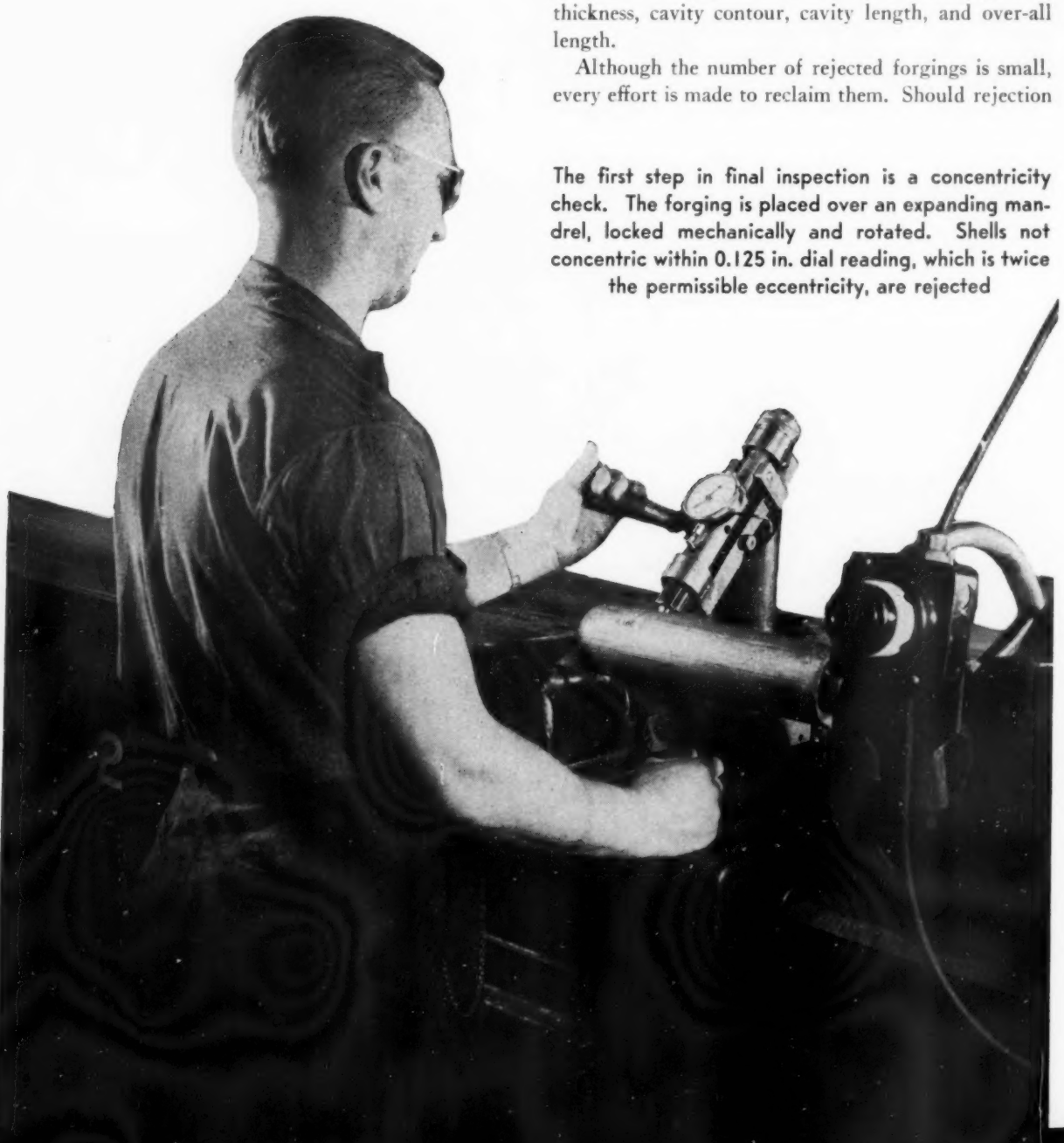
The forging is then placed on the loading platform of the draw bench between the punch and draw rings so that the punch in its cycle enters the pierced hole and pushes the shell through four draw rings as shown in one of the illustrations. On the return stroke of the punch, the forging is pulled from the punch by two latch-type stripper plates arranged radially around the last draw ring. This arrangement is shown in one of the drawings.

The forging drops to an inclined table for stenciling. It is placed on a table where cavity depth, over-all length and outside diameter are checked. Every tenth forging is also checked for concentricity. Inaccuracies in the forging, therefore, can be corrected long before they reach final inspection by making needed changes in the punches or die sets.

At the start of each shift, or after a lengthy shutdown of the press, several billets heated to forging temperature are run through the piercing and drawing mandrels and dies to bring them up to temperature before actual forging is attempted. This has been a major factor in the reduction of rejected forgings from this press.

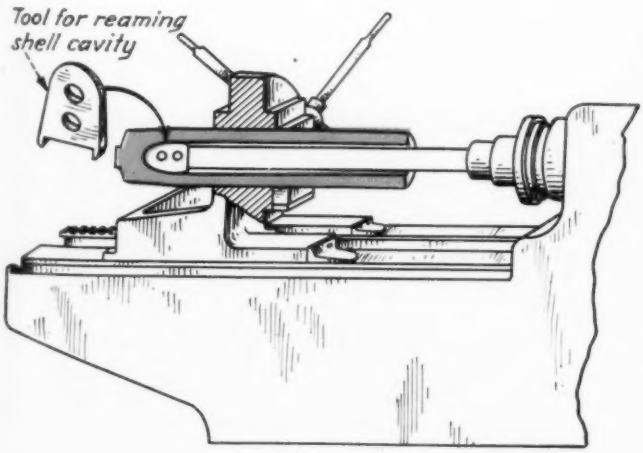
After drawing, the shell forgings are placed in 4×5-ft. sand-pit trays to cool. Each pit is filled with ordinary clean river sand to a depth of approximately 4 in. The hot forgings are placed upright with the cavity end buried in the sand, and are spaced approximately 2 in. apart by inserting in 4-in. square heavy wire mesh bolted to the top of the tray. The forgings take about six hours to cool sufficiently for ready handling in later operations. The forgings are grit blasted to remove scale from the cavity and are checked for Brinnel hardness. Plant and government inspectors check the forgings for diameter, concentricity, wall thickness, cavity contour, cavity length, and over-all length.

Although the number of rejected forgings is small, every effort is made to reclaim them. Should rejection



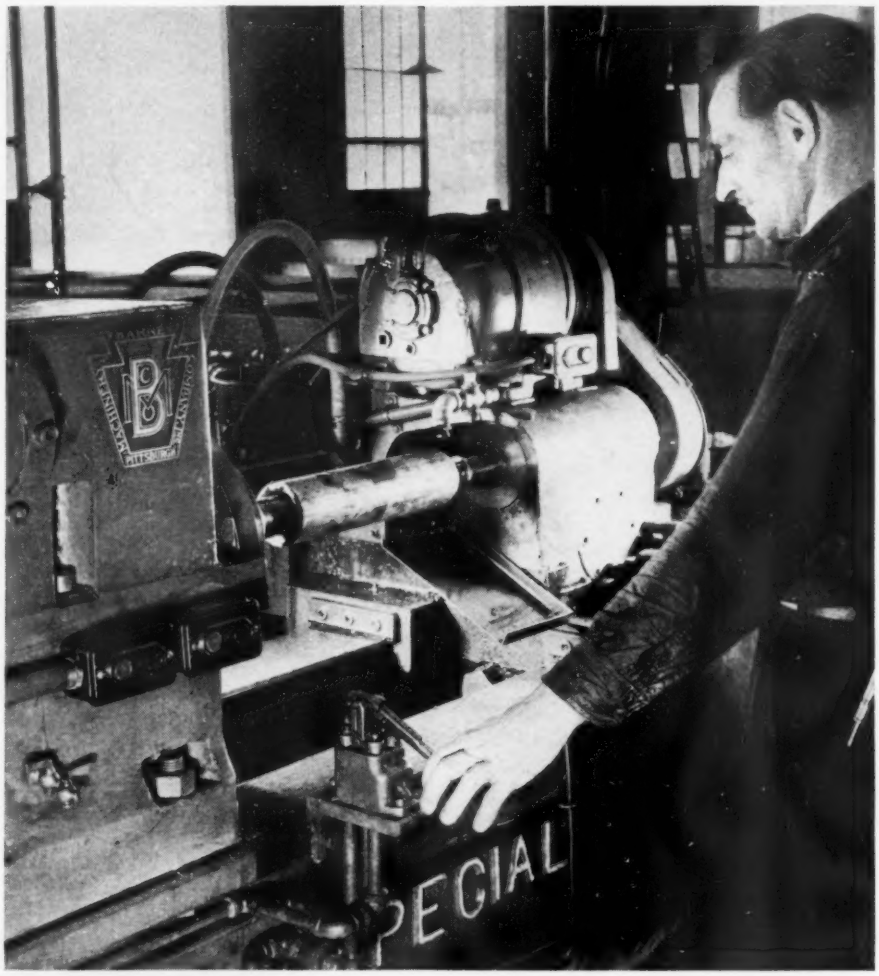
The first step in final inspection is a concentricity check. The forging is placed over an expanding mandrel, locked mechanically and rotated. Shells not concentric within 0.125 in. dial reading, which is twice the permissible eccentricity, are rejected

Finished forgings are inspected for cavity contour, cavity depth, diameter and over-all length. Accepted forgings are stenciled. Minor defects that cause rejections are corrected by machining, provided such machining does not bring the shell below limits specified by the company which finish machines them

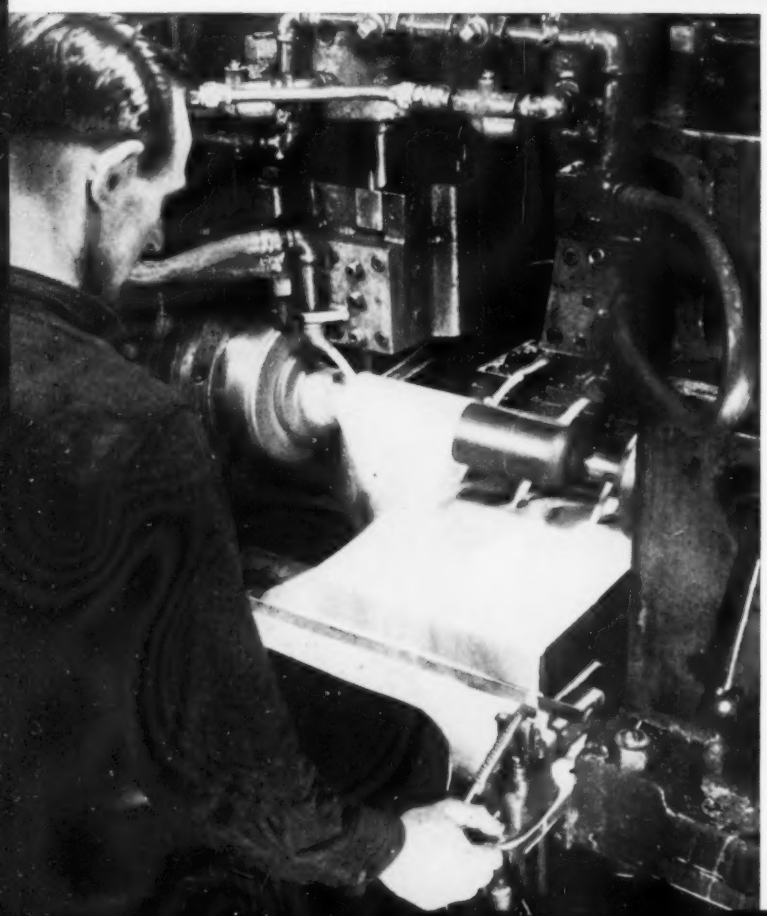


Forgings rejected because of slight variation in contour at the bottom of the cavity are frequently reclaimed by reaming. An old Landis threading machine was converted for this job

Pits, slight eccentricity and improperly formed base are causes of rejection. These can be corrected by machining. Short forgings, although not suitable for high explosive shell, can be turned to a still shorter length for use as another type of shell. Preparatory to such machining, the forgings are centered in this Barney lathe



Machining to correct slight errors in the forging is done in this Barney shell-turning lathe. The manufacturer is permitted to ship forgings turned to a specified minimum outside diameter that conforms to the first rough-machining operation in the plant of the company which finishes the shell



be based on a bad cavity, due to built-up scale or a scored punch, the bottom of the cavity is reamed with a two-lipped cutter. This cutter is bolted to a mandrel on the spindle of a converted Landis threader. The shell forging is gripped in the vise of the threader and fed against the cutter by hand. Several revolutions of the tool are frequently sufficient to remove the cause of rejection.

Shells rejected because of eccentricity are turned concentric, providing the metal removed does not bring the outside diameter below that specified by the company which finish machines the shell.

If the forging is short of the length specified for a high-explosive shell, it is machined to the length specified for another type of shell.

Should rejections be based on pits on the outside surface, the shells are turned to the limit of rough-machined outside diameter specified by the final manufacturer of the shell.

Occasionally rejection is based on an incorrectly shaped base. In this case the forging is centered, chucked in a lathe, and the base is faced off to limits specified by the final manufacturer.

TWO Coolant Streams Improve Grinding

Soluble oil hits inside and outside of plane engine cylinders and removes high heat from thin walls. The method speeds set-ups and limits rejections

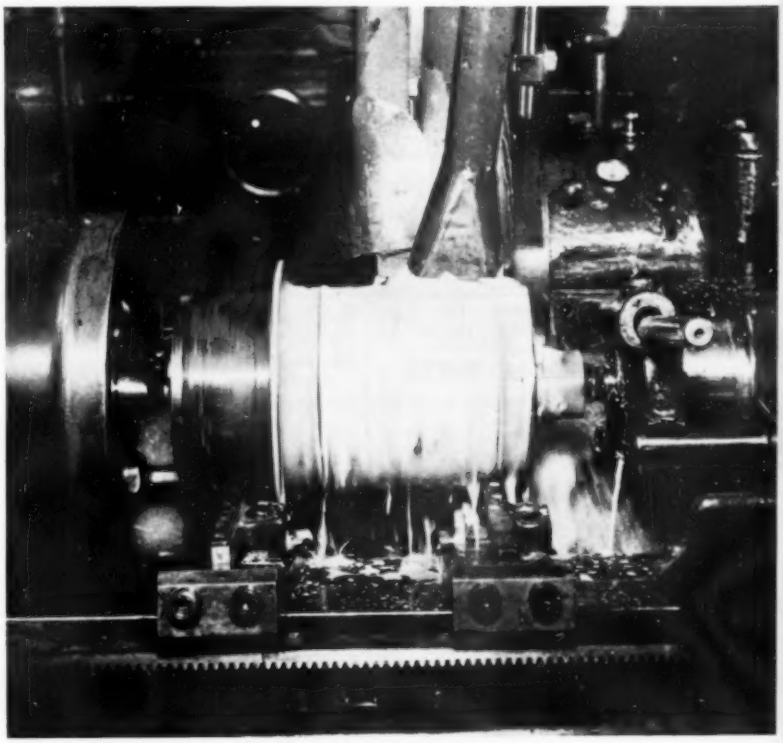
IMPORTANT INCREASES in production for each of three related operations on the Pratt & Whitney cylinder barrel have been achieved at the Ford Aircraft engine plant through development of a patented water-cooled arbor for grinding the muff diameter. Ordinarily, the work is held in an expansion collet, which may permit a runout of 0.001–0.002 in. and coolant is applied only to the outside of the part. Rough and finish grinding operations upon the muff diameter with this type of set-up consumes 90 min.

Coolant is Pumped Through Cylinder

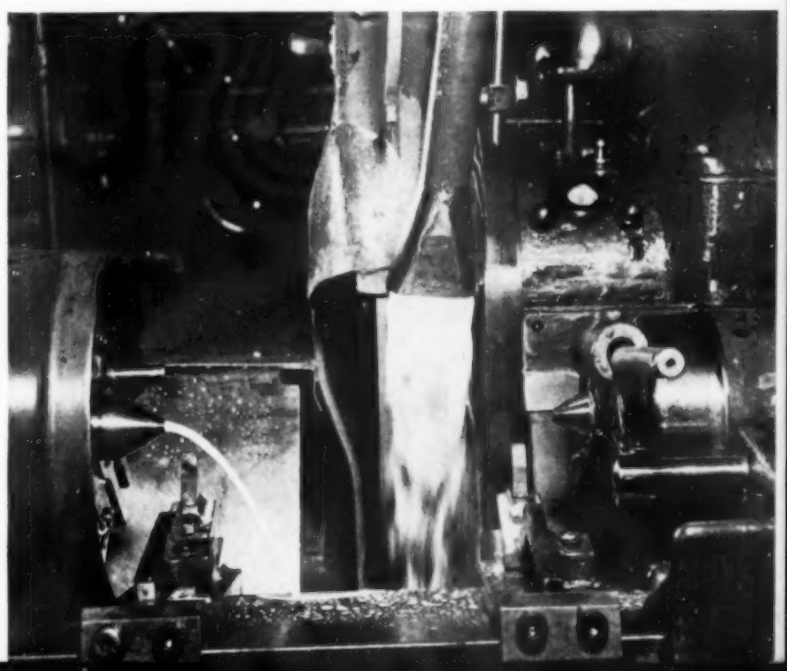
The Ford method, arising from experience in development of sleeves for automobile engines, consists of an arbor that clamps the work at the ends to avoid distortion, and allows the circulation of clean coolant through the cylinder barrel as well as the usual flow at the point of wheel contact. All grinding heat is thus removed from the thin-walled part. At 6500 surface ft. per min., the barrel is finish ground from the "black" in 20 min. or less, run-out is held to 0.0005 in., wheel wear is reduced, and scrap loss from dimensional inaccuracy, checks, cracks, or Magnaflux rejections is practically non-existent. A high-quality finish is promoted because of the complete removal of heat from the work.

Foundation of the arbor, Fig. 1, is the hollow barrel *A* which has orifices to admit coolant (supplied through hollow centers) to the interior of the work. The part is clamped between driving plates *B* and *C*. Plate *C* is a close fit with the ground shoulder on *A* and is firmly clamped against the end of the cylinder barrel by means of a C-washer *D* and knurled handnut *E*. Replaceable centers *G* and *H* are an important feature of the construction.

The arbor is mounted between machine centers, Fig. 2, which are drilled to permit a continuous flow of clean coolant from the machine pump. Coolant is



By use of a special arbor, soluble oil floods the interior as well as the exterior of the work, while grinding the muff diameter in one set-up. Coolant for the interior of the barrel flows from a hollow headstock center (right) discharges from an orifice in the tailstock center (left)



admitted to the hollow machine spindle by a pipeline and packless universal joint. A valve fitted to the tailstock center regulates the pressure of coolant within the cylinder barrel at about one pound per square foot.

Development of the arbor for grinding the outside diameter of the muff has enabled a 50 percent gain in production and increased quality on two subsequent operations upon the cylinder barrel. The arbor is left in place for grinding the barrel thread, the machine having been supplied with centers for the purpose. This practice saves the double handling formerly required—taking off and replacing drivers. Since the part is held without distortion by end clamping, the thread produced is of better quality. Construction of the arbor is such as to prevent any soluble oil inside from draining into the thread grinding oil.

When finish grinding the bore originally, the piece was chucked at the crankcase end, leaving the muff diameter hanging in the air. Time was thus consumed in indicating the piece when setting up, and a glazed wheel might push the barrel out of alignment.

Ground Muff Diameter Centers Piece

The close limit achieved by grinding the muff diameter on the water-cooled arbor, permits the outside diameter to be used for locating in a pot chuck at the Bryant internal grinder. Work clearance in the pot chuck is a 0.0003 in. limit per side. The muff diameter is coated with 600 W oil, which acts as a centralizing cushion. Gripping of the work is done by pulling back on the flange. With this type of set up for grinding the I.D., run-out is held to 0.0003 in. for taper and out-of-roundness. All drumming noise, sometimes present in grinding, is removed. Production has been increased approximately 50 percent and scrap loss is rare.

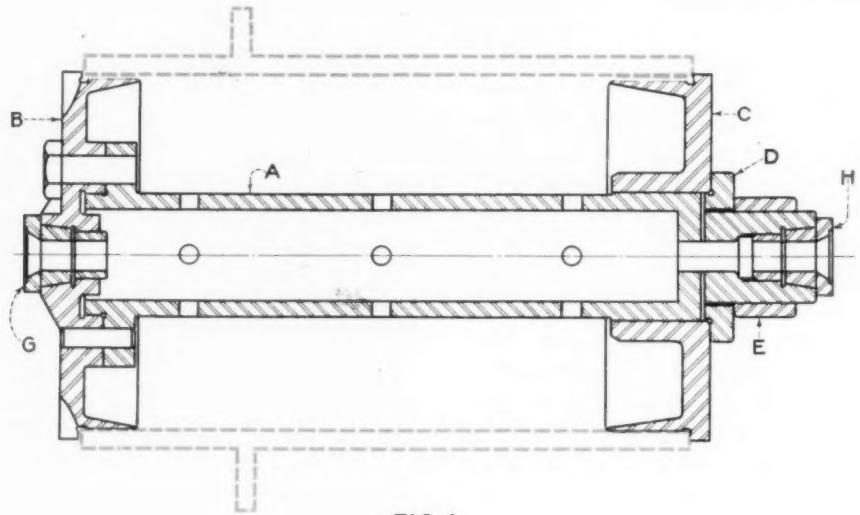


FIG. 1

Made to gage precision, the water-cooled arbor has reduced run-out to 0.0005 in. Grinding coolant is admitted to the water-cooled arbor by the drilled hole through the headstock center; pressure within the cylinder barrel is regulated by a petcock screwed into the tapped cross-hole in the tailstock center

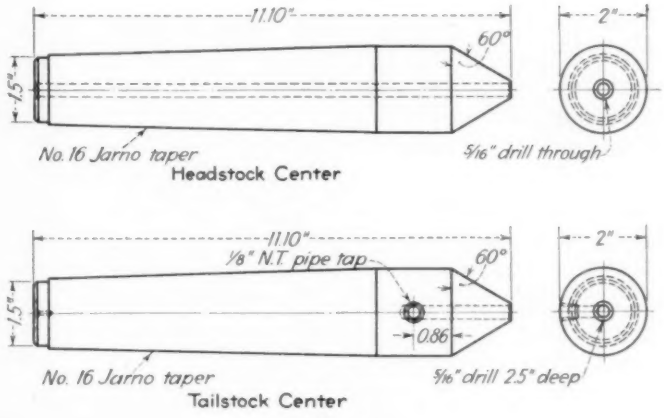


FIG. 2

Screw Thread Gages and Gaging—V

22. Master Gages.

These shall be *plug* gages made to the basic size as accurately as possible. The variations in the basic diameter of master gages must be plus. However, the variations in lead and angle may be either plus or minus. Each master gage shall be marked with an identification number or symbol, and be accompanied by a record of its major diameter, pitch diameter, lead and angle.

23. Tolerances.

Tables 2, 3, and 4 list tolerances for three grades of thread gages, the recommended uses for each being given in Table 1. These tolerances are intended for application of NC, NF, and comparable diameters and pitches.

24. W Gages.

For the inspection of Class 4 product, gages made within especially close tolerances are necessary. The tolerances for such gages, designated as *W*, are given in Table 2.

25. X Gages.

X gages should be suitable for inspection and setting gages for Classes 1, 2, and 3, except that in some cases *W* gages may be desirable for Class 3 setting plugs. The tolerances on these gages are given in Table 3. In all cases the tolerance for "go" gages shall be such that the gage does not fall outside of the component tolerances. When a thread plug gage is used as the "go" gage for checking a tapped hole, it may be larger, but not smaller than the minimum size specified. On the other hand, when a thread plug gage is used as the "go" setting plug for thread ring gages or for optical or other comparators, it may be smaller, but never larger than the maximum size of the screw.

26. *X* tolerances, as given in Table 3 are specified for all "not go" gages for Classes 1, 2 and 3.

27. Y Gages.

Y "go" gages should be suitable for inspection and working gages for Classes 1 and 2 fits, $\frac{1}{4}$-in. diameter and larger. For diameters less than $\frac{1}{4}$ in., *X* gages should be used. They may also be desired as working gages for Classes 2 and 3 fits. The tolerances on these gages are given in Table 4.

28. Tolerances on Lead.

The tolerances on lead given in Tables 2 to 4, inclusive, are specified as an allowable variation between any two threads, not farther apart than the length of engagement of the assembled threaded product.

29. Tolerances on Angle of Thread.

The tolerances on angle of thread, as specified in Tables 2 to 4, inclusive, for the various pitches, are tolerances on

Table 3 Tolerances for X "Go" Thread Gages and "Not Go" Thread Gages for Classes 1, 2, and 3

(Applicable to NC, NF, and Comparable Diameters and Pitches)

Threads per Inch	Tolerance on Pitch Diameter[1]		Tolerance in Lead[2]	Tolerance on Half Angle of Thread		Tolerance on Major or Minor Diameter[3]	
	From—	To—		Deg	Min	From—	To—
				±			
80	0.0000	0.0002	0.0002	0	30	0.0000	0.0003
72	0.0000	0.0002	0.0002	0	30	0.0000	0.0003
64	0.0000	0.0002	0.0002	0	30	0.0000	0.0004
56	0.0000	0.0002	0.0002	0	30	0.0000	0.0004
48	0.0000	0.0002	0.0002	0	30	0.0000	0.0004
44	0.0000	0.0002	0.0002	0	20	0.0000	0.0004
40	0.0000	0.0002	0.0002	0	20	0.0000	0.0004
36	0.0000	0.0002	0.0002	0	20	0.0000	0.0004
32	0.0000	0.0003	0.0003	0	15	0.0000	0.0004
28	0.0000	0.0003	0.0003	0	15	0.0000	0.0005
24	0.0000	0.0003	0.0003	0	15	0.0000	0.0005
20	0.0000	0.0003	0.0003	0	15	0.0000	0.0005
18	0.0000	0.0003	0.0003	0	10	0.0000	0.0005
16	0.0000	0.0003	0.0003	0	10	0.0000	0.0006
14	0.0000	0.0003	0.0003	0	10	0.0000	0.0006
13	0.0000	0.0003	0.0003	0	10	0.0000	0.0006
12	0.0000	0.0003	0.0003	0	10	0.0000	0.0006
11	0.0000	0.0003	0.0003	0	10	0.0000	0.0006
10	0.0000	0.0003	0.0003	0	10	0.0000	0.0006
9	0.0000	0.0003	0.0003	0	10	0.0000	0.0007
8	0.0000	0.0004	0.0004	0	5	0.0000	0.0007
7	0.0000	0.0004	0.0004	0	5	0.0000	0.0007
6	0.0000	0.0004	0.0004	0	5	0.0000	0.0008
5	0.0000	0.0004	0.0004	0	5	0.0000	0.0008
4½	0.0000	0.0004	0.0004	0	5	0.0000	0.0008
4	0.0000	0.0004	0.0004	0	5	0.0000	0.0009

All dimensions are given in inches, except where otherwise stated.

[1] On "go" plugs the tolerance is plus, and on "go" rings the tolerance is minus. On "not go" plugs the tolerance is minus but may be plus and on "not go" rings the tolerance is plus but may be minus. (See Par. 17.) (Not applicable to setting plugs. See tables of limiting dimensions for thread plug and thread ring gages.)

[2] Allowable variation in lead between any two threads not farther apart than the standard length of engagement, which is equal to the basic major diameter.

[3] On "go" plugs the tolerance is plus, and on "go" rings the tolerance is minus. On "not go" plugs the tolerance is minus, and on "not go" rings the tolerance is plus. (Not applicable to setting plugs. See tables of limiting dimensions for thread plug and thread ring gages.)

A MESSAGE TO CALIFORNIA
WE ARE PLEASED TO ANNOUNCE THE APPOINTMENT OF SANDVIK STEEL INCORPORATED, 4415 SOUTH MAIN ST., LOS ANGELES, AS OUR REPRESENTATIVES IN SOUTHERN CALIFORNIA ... THIS NEW CONNECTION WILL BE OF PARTICULAR BENEFIT TO OUR MANY FRIENDS AND CUSTOMERS IN THIS TERRITORY.

WEBBER SERVES THE AIRPLANE INDUSTRY

In spite of the cold back here we are working 24 hours a day to maintain the vital accuracy required of tools for speeding the production of airplanes.

Webber Gage Blocks provide a constant unit of precision essential to achieving the uniform accuracy of parts demanded in the "line production" of airplanes.

We are proud of the experience, skill and craftsmanship that goes into Webber Gage Blocks —that makes them dependable units of measure for the great airplane industry.

If you are working with tolerances of .001" or less you should be using Webber Gage Blocks constantly—through every step of your operation. Write for literature.

For the duration Webber's entire productive capacity is being devoted to the manufacture of GRADE A GAGE BLOCKS only.

Webber GAGE COMPANY

12901 TRISKETT RD., CLEVELAND, OHIO

Prompt delivery to firms furnishing necessary priorities. Prices for Set No. 81A—$350.00. Set No. 40A—$185.00.

Screw Thread Gages and Gaging—VI

one-half of the included angle. This insures that the bisector of the included angle will be perpendicular to the axis of the thread within proper limits. The equivalent deviation from the true thread form caused by such irregularities as convex or concave sides of thread, rounded crests, or slight projections on the thread form should not exceed the tolerances permitted on angle of thread.

30. Thread Form of Thread Plug and Ring Gages.

(*a*) *"Go" Thread Gages.* The pitch diameter of the *W* and *X* "go" thread plug gages is the same as the minimum pitch diameter of the threaded hole or nut. The tolerance on this dimension is plus.

The major diameter of the "go" thread plug gage is the same as the basic major diameter, with a plus gage tolerance. The pitch diameter of the *W* and *X* "go" thread ring gage is the same as the maximum pitch diameter of the screw. The tolerance on this dimension is minus. The minor diameter of the "go" thread ring gage is the same as the minimum minor diameter of the nut or tapped hole with a minus gage tolerance.

A relief (which may be in the form of a "V") is provided at the root of the "go" thread plug or thread ring gage, the width of which is not greater than one-eighth of the pitch.

(*b*) *"Not Go" Thread Gages.* The pitch diameter of the "not go" thread plug gage is the same as the maximum pitch diameter of the threaded hole or nut. The tolerance on this dimension is minus but may be plus (See Par. 17). The crest of the thread of the "not go" plug gage is truncated below its basic major diameter such an amount that the width of the flat at the crest will be equal to one-fourth of the pitch, with a minus gage tolerance.

(*c*) Specifications for major diameter of truncated setting plugs:

(1) The major diameter of the full portion of the "go" setting plug is that of a full American National form based on the maximum pitch diameter of the screw. The tolerance on this dimension is plus.

Table 4 Tolerances for Y "Go" Thread Gages

(Applicable to NC, NF, and Comparable Diameters and Pitches)

Threads per Inch	Tolerance on Pitch Diameter[1]		Tolerance in Lead[2]	Tolerance on Half Angle of Thread		Tolerance on Major or Minor Diameter[1]	
	From—	To—		Deg	Min	From—	To—
				±			
80	0.0001	0.0003	0.0002	0	45	0.0000	0.0003
72	0.0001	0.0003	0.0002	0	45	0.0000	0.0003
64	0.0001	0.0004	0.0002	0	45	0.0000	0.0004
56	0.0001	0.0004	0.0002	0	45	0.0000	0.0004
48	0.0001	0.0004	0.0002	0	45	0.0000	0.0004
44	0.0001	0.0004	0.0002	0	30	0.0000	0.0004
40	0.0001	0.0004	0.0002	0	30	0.0000	0.0004
36	0.0001	0.0004	0.0002	0	30	0.0000	0.0004
32	0.0001	0.0004	0.0003	0	20	0.0000	0.0004
28	0.0002	0.0005	0.0003	0	20	0.0000	0.0005
24	0.0002	0.0005	0.0003	0	20	0.0000	0.0005
20	0.0002	0.0005	0.0003	0	20	0.0000	0.0005
18	0.0002	0.0005	0.0003	0	15	0.0000	0.0005
16	0.0002	0.0006	0.0003	0	15	0.0000	0.0006
14	0.0002	0.0006	0.0003	0	15	0.0000	0.0006
13	0.0002	0.0006	0.0003	0	15	0.0000	0.0006
12	0.0002	0.0006	0.0003	0	10	0.0000	0.0006
11	0.0002	0.0006	0.0003	0	10	0.0000	0.0006
10	0.0002	0.0006	0.0003	0	10	0.0000	0.0006
9	0.0002	0.0007	0.0003	0	10	0.0000	0.0007
8	0.0002	0.0007	0.0004	0	5	0.0000	0.0007
7	0.0002	0.0007	0.0004	0	5	0.0000	0.0007
6	0.0003	0.0008	0.0004	0	5	0.0000	0.0008
5	0.0003	0.0008	0.0004	0	5	0.0000	0.0008
4½	0.0003	0.0008	0.0004	0	5	0.0000	0.0008
4	0.0003	0.0009	0.0004	0	5	0.0000	0.0009

All dimensions are given in inches, except where otherwise stated.

[1] On "go" plugs the tolerance is plus and on "go" rings the tolerance is minus.

[2] Allowable variation in lead between any two threads not farther apart than the standard length of engagement, which is equal to the basic major diameter.

Table 5 Tolerances for Plain Gages

Size Range		X	Y	Z
Above	To and Including			
0.029	0.825	0.00004	0.00007	0.00010
0.825	1.510	0.00006	0.00009	0.00012
1.510	2.510	0.00008	0.00012	0.00016
2.510	4.510	0.00010	0.00015	0.00020
4.510	6.510	0.00013	0.00019	0.00025
6.510	9.010	0.00016	0.00024	0.00032
9.010	12.010	0.00020	0.00030	0.00040

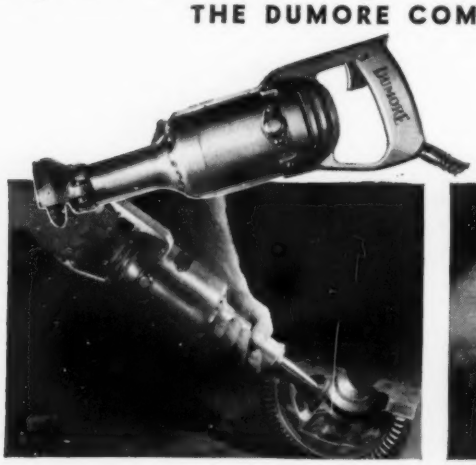
All dimensions are given in inches.

When Time Is Short and Labor Is Scarce

You Can Do More With a Dumore

Save time, avoid costly delays and keep up your production schedules . . . with Dumore Hand Grinders. Touch up dies, sharpen your cutting tools, clean up welding points, take off high spots on castings, get into those tight corners . . . do a thousand other jobs with Dumore Hand Grinders . . . the handy precision tools with plenty of power. Hundreds of uses have been found for them on production lines, too, especially in important war work, where speed and precision are paramount. Dumore Hand Grinders are built to stand up under heavy schedules . . . from shift to shift . . . right around the clock. Extra power hours are built into their motors. They're put through the severest tests, rotating parts are dynamically balanced to eliminate vibration, reduce operator fatigue, and provide finger-tip balance for the utmost precision and control. Let Dumore suggest ways to save man hours, materials and costs. Call your nearest distributor, or write.

THE DUMORE COMPANY, DEPT. 133-A, RACINE, WISCONSIN

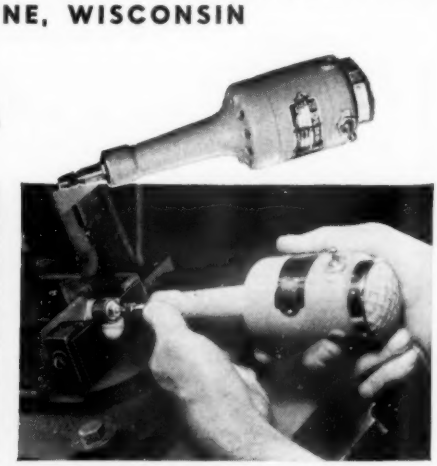


DUMORE No. 9

Big and powerful, yet easy to handle. Weighs only 7½ lbs. Packs a ½ h.p. motor. Smooth and vibrationless, it idles at 15,500 r.p.m. Forced ventilation, built-in air filter, convenient trigger switch in sturdy end-handle. Biggest of the three.

DUMORE No. 8

Smallest of the three. Snappy 1/20 h.p. motor that sings along at 18,000 r.p.m. Perfectly balanced for finger-tip control. Weighs but 38 oz. yet every ounce a Dumore, with every Dumore feature. A high speed grinder for fine finishing.



DUMORE No. 10

Intermediate and most popular model, widely used for all types of off-hand grinding, weighs 47 oz., develops 20,000 r.p.m. by a 1/10 h.p. motor. Built for production work, with more power, more speed, but without excess weight.

Dumore

PRECISION GRINDERS

Let's Revive "Incentives"

REMEMBER when it was considered proper to operate "incentive systems" as a means for increasing production?

Any plan incorporating the word "incentive" in its title has been taboo in recent years. It was put in the same outlawed class as "labor saving." Even today, when labor saving is a major problem, we call it by some other name such as "time saving."

Incentive systems came into disrepute because labor unions insisted they were little more than ingenious devices for speeding up production to squeeze more work out of the men. The minute a manufacturer introduced an incentive plan, the union chief shouted "speed-up," a word which was one of the worst epithets that could be hurled at industry.

The result was that "incentives" went into retirement. No one talked about them. If a company wished to use the incentive principle, it coined a less recognizable name for its plan.

When manpower is rapidly becoming our No. 1 war problem, isn't it time for us to get over the foolish notion that incentive systems are to be condemned?

Strange as it may seem, the incentive system is hard at work in the country where all people are supposed to have been leveled off onto one common plane—Soviet Russia.

Soviet leaders discovered that paying everyone the same wage, regardless of ability, wasn't such a hot idea. It failed to bring the desired production results.

Incentive systems have much to commend them. They reward a man in proportion to his output. They make it desirable in dollars and cents for him to produce to the best of his ability. They are a war production weapon of the highest importance.

Fortunately, new ways are being opened up for making better use of our manpower. Just how vital this may be to the war effort is shown by the fact that an increase of 25 percent in output per worker would be equivalent to adding nearly four million people to the existing fifteen million in war industries.

In the drive to obtain such an increase, the incentive principle should not be overlooked. The War Labor Board itself has taken the lead in removing "incentives" from the black list. It issued a recent order permitting wage increases based on superior skill and on greater productivity under incentive wage plans.

The idea of "incentives" is essentially American. It is democratic. It gives each employee a chance to prove his worth. If he is better than his fellow worker, he benefits. If he loafs on the job, he gets less than the other fellow, as he should. Operated fairly, an incentive system is a stimulus to production throughout an entire shop.

Let's revive it and put it to work for Uncle Sam.

Burnham Finney

GAGING BUSINESS

As Skilled Manpower becomes scarcer, the demand for highly automatic machines increases. Machine tool order backlog is being whittled down, output may drop. Bigger aircraft projected. First quarter steel shortage seen

More Machines, Less Operators Scarcity of skilled machine operators and dependence of factories on workers with little or no previous machine shop experience are resulting in large orders being placed by war contractors for special, single-purpose machine tools run by push-button control. All the operator must do is to load and unload the work, pressing a button to start the machine.

The demand for special, multi-operation machines, which perform a number of machining operations simultaneously, is pronounced in the aircraft industry. It is in contrast with the call up to now mostly for general-purpose machine tools. The trend toward special machines is partly attributed to the desire to adopt mass production methods.

This tendency has put a heavy burden on makers of special machinery, who already had order books filled through most of 1943. In fact, all machine tool builders turning out tools for aircraft manufacture are extremely busy on orders in connection with the proposed greatly enlarger plane program.

Getting Orders Under Control New machine tools to be delivered during the first quarter of this year provide the key to the progress of the aircraft expansion plan. To expedite the output of these badly-needed machines, the individual machine tool companies involved are working round the clock. Aside from aircraft, however, the push for machine tools is not so great as it was. Backlogs are beginning to be worked down to less imposing proportions. In some sizes of certain types of machine tools, deliveries can be made within two or three months, and sometimes sooner, on current business.

Though the war production program is being scaled down to fit the amount of raw materials available, machine tool orders will not be pared down proportionately. This is understandable, because many of the cancelled orders for munitions items are merely duplicates of orders previously placed for which production lines had been tooled up.

Machine Tool Output to Drop While unfilled orders of the machine tool industry are being steadily reduced as production exceeds new demands, the operating rate probably will stay close to the peak volume of $130 millions a month. Within a few months, however, output of machine tools is expected to turn downward for the first time since the war began. This event will signify that tooling up for the war effort is pretty well completed. Machine tool demand, however, should continue far beyond peacetime totals as long as the war lasts. Several machine tool companies are in the process of negotiating for war contracts for items outside the machine tool field to take up extra capacity which soon may be unused. Even if domestic war business should fall off, as predicted, the slack will not be taken up by increasing the flow of machine tools to other members of the United Nations. For one thing, shipping space won't be available. At present 25 percent of the industry's output is permitted to go abroad.

Mighty Big and Still Going Up Contemplated aircraft production is so big that the public and even industry do not appreciate the vast scope of the expansion program. Procurement of a certain material, used in all planes in varying amounts, will be stepped up three times. The necessary equipment with which to fabricate this material is being rushed to completion by means of triple A priorities.

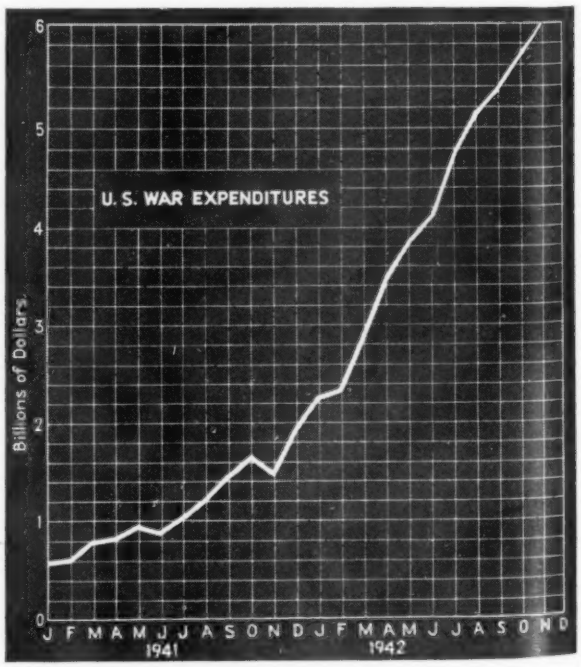
No definite figures can be printed about aircraft output, but the fact is known that great difficulty is being experienced in meeting the production schedule set for January. Ordnance production continues good, with important shifts occurring to conform to the requirements of the armed services. In certain cases, operations on tank lines are being shifted over to tank destroyers. Many shell plants have been asked to cut down production.

Conversion vs. New Facilities The balance of munitions manufacture with the available supply of raw materials is fairly satisfactory at the moment. A sudden change in war needs, however, would throw it out at any time. Many top officials now realize that more pressure from the start should have been put on conversion of existing plants and less on new facilities, many of which will not be required.

No regrets are voiced, on the other hand, about expansions in raw materials capacities, many of which have not yet attained the maximum set.

First Quarter Shortage Seen A real shortage of steel will exist in the first quarter, but considerable improvement should appear by the second quarter. Attempts have been made and are being made to ferret out excess inventories and redistribute them to people who need materials badly, but this is a difficult process. The difference between work in process and raw materials inventory, for example, may be little more than "a corner chipped off."

Hitting a New High — During November U. S. war expenditures were $6,041,000,000, or an increase of 5.6 percent of October's $5,722,000,000. October had exceeded September by 4.8 percent. Total U. S. expenditures since July 1, 1940, now amount to $61,888,000,000



Manning Table Is Basis for Deferments, Replacements

With McNutt firmly in control of the Selective Service System, a simplified version of the manning table will be used as a scientific basis for deferments by plants

BY ROBERT COLBORN

WASHINGTON—There are plenty of long-range implications to the revivification of the War Manpower Commission as a result of last month's executive order increasing Paul McNutt's authority. But the immediately important affect on employers is the change in draft procedure which is resulting.

Initially, two things have happened to the draft. Elimination of voluntary enlistment is welcome to employers, many of whom have lost more men by enlistment than to the draft. Equally, if not more significant is a simplified version of manning table to be used for regularizing drafting of workers from war plants.

The manning table idea was first developed in the Selective Service System as a way of improving the admittedly unscientific occupational deferment procedure. Scheme was that instead of deciding the deferment of each man as his number came up, a general schedule of deferments would be worked for the entire personnel of a plant. The idea was taken over by the manpower people and broadened to include a general study of the manpower policies of the plant—labor hoarding, utilization of women, training and upgrading, estimates of future needs, etc. In this form it was first made public a month ago.

Interim Plant Proposed

Clearly, however, preparation by industry of manning tables and study and approval of them by WMC is a slow, painstaking process. So Selective Service proposed an interim procedure by which the portion of the work involving draft deferment would be done first and used to guide local draft boards. WMC was dubious about this plan, fearing that if the juicy draft deferment material were isolated into a "replacement schedule" as proposed by SSS, employers would have no inducement to make out complete tables.

The executive order giving McNutt clear control over SSS, provided WMC with assurance that it could keep control of the situation. The plan thereupon went through on the basis that replacement schedules will be good for six months, that WMC regional offices may require completion of a manning table as a condition for renewal of the replacement schedule.

Introduction of the replacement schedule idea does two things. It provides a quick way of getting consideration of an employer's total draft deferment problem. And it tacitly changes the basis of occupational deferment. Up to now, a man has been eligible for deferment if (1) he worked in an essential industry, and (2) he held a job in that industry requiring skill and substantial training.

Any firm in an essential industry may prepare a replacement schedule. First step is to obtain from all employees data on: job title, age, local board number, draft number and classification, family status. Then a "replacement summary" can be prepared listing by jobs, all employees, showing how many are (1) women, (2) men not immediately liable to be drafted because of age, 4-F draft classification, or because they have children (children born more than nine months after Pearl Harbor are not counted), and (3) men likely to be drafted.

Derive Replacement List

Next step is preparation of a "replacement list." This is a list, by name of those men who fall in the draftable group. For each man, the number of months required to replace him is indicated. This will depend not only on the time required to replace a single man by training, up-grading, or recruiting, but also on the rate at which the firm can carry on replacement. Thus, suppose it takes about three months to train a sub-foreman, but the employer only feels able to have two in training at a time. Then the schedule might provide for replacing one man in three months, another in four, etc.

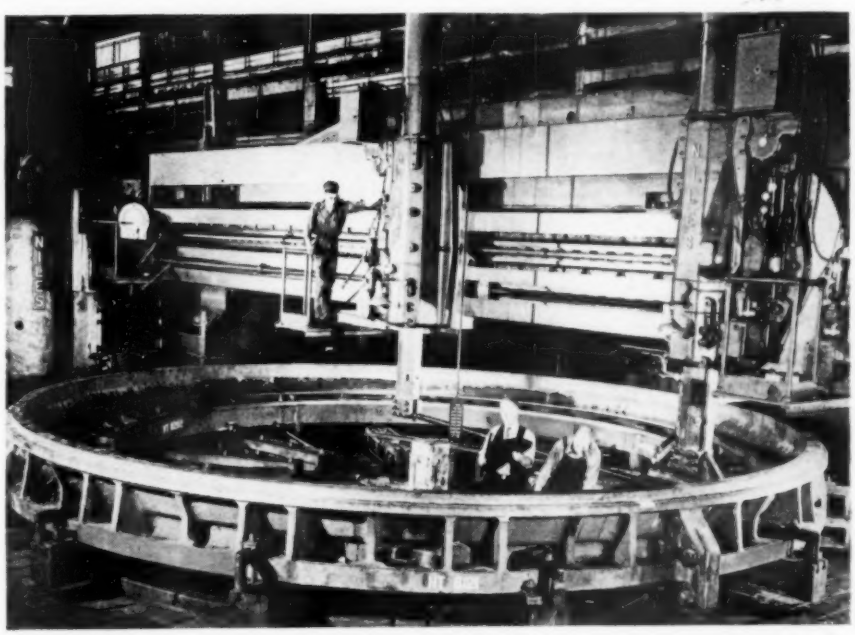
Whenever such staggered replacement arrangements are used, the order of replacement should be determined by replacing single men first, in the order of their draft order numbers, then married men according to their draft numbers (wives acquired after Pearl Harbor don't count).

State Directors Approve

When the two documents constituting the replacement schedule are finished they are submitted for approval to the state director of selective service.

If the schedule is approved, it will be given an approval number so indicating. Then the employer should submit to the local boards a form 42A (request for class II deferment) for each of the men on his replacement list. For each man, he will request deferment until the month indicated on the approved replacement list, and will include the approval number of his replacement schedule.

Draft boards, legally autonomous, are not bound to grant the deferment so requested, but they are expected to do so in most cases.



Machining Gun Mount Base—This big metal ring—the base for a large gun mount—is being machined on a giant boring mill at Westinghouse Electric & Manufacturing Company's East Pittsburgh Works. Shipped in four sections, the ring weighs 92 tons. The boring mill depicted above is one of the few in this country large enough accurately to machine this assembled ring

"E" Burgees and "M" Pennants Are Awarded to Many Firms, While Others Get Renewals

WASHINGTON — With many plants attaining, or surpassing capacity, "E" and "M" awards are being made each week to an increasing number of them. Meanwhile, other plants are having their award renewed for continuance of the high degree of perfection that brought it to them originally. Renewal of the award is designated by the addition of a star to the original "E" burgee or "M" flag.

"E" Burgees

Acme Pattern & Tool Co., Allis-Chalmers Mfg. Co. Tractor Wks., Altorfer Bros. Co., American Optical Co., Andover-Kent Aviation Corp., Aro Equipment Corp., Atlantic Steel Co. Div. of National Standard Co., Bakewell Mfg. Co., Bantam Bearings Corp., Bryant Heater Co., Bucyrus-Erie Co., Cadillac Motor Car Div. General Motors Corp., Chromium Corp. of America, Cleereman Machine Tool Co., Converse Rubber Co., Crescent Truck Co., Crucible Steel Co.

Damascus Steel Products Corp., Davis & Geck, Inc., Delta Mfg. Co., DeVilbiss Co., Dow Chemical Co., E. I. duPont de Nemours & Co., Edwards Co. Div. of Rogers Diesel & Aircraft Corp., Estate Stove Co., Federal Products Corp., Ferris Instrument Co., General Electric Co. (Ontario Wks. plant), General Motors Corp. (Fisher Body, Fisher Tank Arsenal, Hyatt Bearing Div., Proving Ground), H. M. Harper Co., Hercules Motors Corp., Horni Signal Mfg. Corp., Hudson Motor Car Co. Airplane Div., Ilex Optical Co., International Business Machines Corp. (Plant 1).

Johnson Motors, Jones & Laughlin Steel Corp. (Aliquippa plant), R. G. LeTourneau, Inc., Lima Locomotive Wks. Shovel & Crane Div., Mathews Conveyor Co., McDonald Mfg. Co., Macwhyte Co., J. Mergenthaler & Son, Ocean City Mfg. Co., Ohio Steel Foundry Co. (Lima and Springfield plants), H. K. Porter, Inc., Pullman Standard Car Mfg. Co., Robinson Industries, Inc., Sharples Chemicals, Inc., Southern Steel Co., Superior Steel & Malleable Castings Co.

S. G. Taylor Chain Co., Todd & Brown, Inc., Unitcast Corp. (Plant 1), United States Automatic Corp., United Wire & Supply Corp., Vega Aircraft Corp., Victor Equipment Co., Wallace & Tiernan Products, Walworth Co., Weir Kilby Corp., Western Stove Co., Westinghouse Electric & Mfg. Co. (E. Springfield), Whitney Blake Co.

"M" Pennants

Alabama Dry Dock & Shipbuilding Corp., Alcoa Div. American Locomotive Co., Cooper-Bessemer Corp., Davis Engineering Corp., Delta Shipbuilding Co., Federal Telephone & Radio Corp., Houston Shipbuilding Corp., Linde Air Products Co., Minneapolis-Moline Power Implement Co., National Supply Co. Superior Engine Div., Production Engineering Co., Security Engineering Co., Tube-Turns, Inc., Whitin Machine Wks., Young Iron Wks.

Henry Disston & Sons, Inc. received the burgee and employees and others gathered for the ceremony heard President S. Horace Disston, above, speak of the company's war production record

Buffalo Forge Company's burgee is held by Col. J. M. McDowell, H. W. and E. F. Wendt, company chairman and president, Comdr. R. S. Smith, Rear Adm. W. T. Cluverius and V. Pres. C. A. Booth

Lincoln Park Tool and Gage Co. employees received lapel "E" pins from Commander A. F. Duernberger, through representative L. P. Rollins, below

Standard Gage Company's "E" award ceremony included an address by President Erik Aldebrogh, who accepted the burgee below

INSIDE DETROIT

BY RUPERT LE GRAND

Auto manufacturers will use dies from '42 models to hurry into postwar production. Development of startling new models will take at least two years. Manufacturers are approaching the end of the tooling up period. Manpower shortages trouble them little

Victory Auto Like '42 Model You have heard a great deal about the kind of automobile that will be offered the motoring public after the war. It will be run on 100-octane gasoline. It will have only a small part of the horsepower of present cars. It will weigh half as much as models built in recent years. It will have the engine in the rear, and plastics will be used far more freely. There will be more space inside for passengers and more comfort.

All of those features may be embodied in the post-war automobile. But of one point you may be sure: they will not apply to the car to be manufactured immediately following the cessation of hostilities. On the authority of top officials of the automobile industry. The car which the public first will be able to buy after the war's end will be the replica of 1942 models.

To Hurry Into Production At first blush, this may seem odd. But on examination, this statement is well founded. To design a completely new car, departing radically from previous models, would require at least two full years of preparation. It will not be possible to wait that long to get into production of automobiles. It would be fatal to any chance of post-war prosperity to have the motor car industry virtually idle that length of time. The government itself, eager to see people employed, would not want the key automobile factories shut down that long. The impatient public, deprived of the privilege of purchasing new cars over a considerable period, will be eager to get new cars as quickly as the industry can tool up to build them.

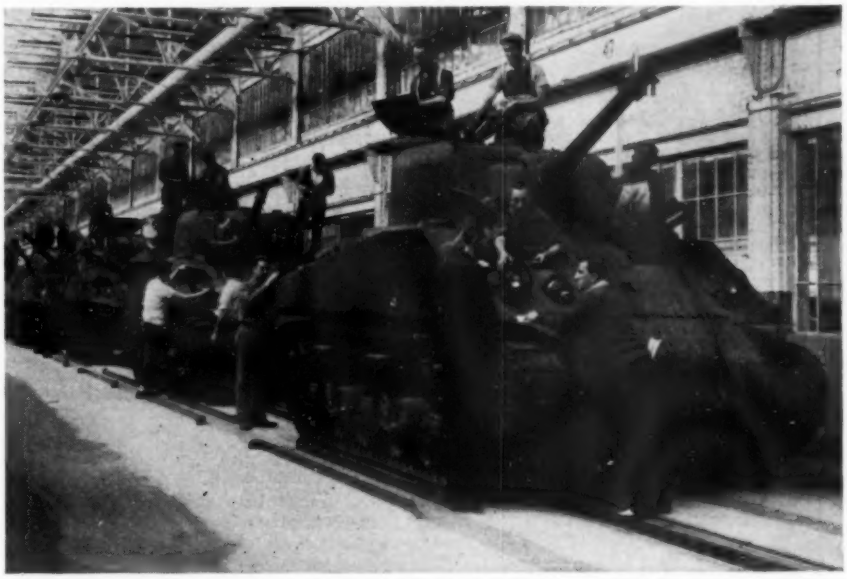
The only logical thing to do in such a situation is for car makers to begin turning out 1942 models again. They still have the dies for those models, having resisted WPB pressure to scrap them. Their production lines are torn down and machinery is scattered badly, and much of it cannot be brought together again. However, much production equipment is stored for use when peace returns automobile making to its former place.

Six Months of Preparation Even with a return to 1942 models or their equivalent, it will take a minimum of six months of preparation. Eight to nine months would be a better guess. As the war lengthens and the automobile industry is more completely converted to war manufacture, the time for retooling for motor car building will be stretched out still more. There will be a race among rival companies to get out the first new peacetime cars. And the retail market should be excellent for a long spell. Nineteen forty-two models will sell like hot cakes. At least that is the thinking at the top level of automobile management.

Despite Henry Kaiser's suggestion to design a 1945 car now and take orders for it (a suggestion which motor car people think is plumb crazy), there is no intention of acting upon it. The reason is simple: The industry has been so absorbed in trying to get going on full war production that hasn't had the time, the manpower or the energy to think about designing cars for the future. In General Motors, for example, experts who formerly devoted their attention to new car designing are spending their days and nights on the perplexing problem of camouflage as well as on other war activities. Perhaps the day may come when the war pressure will ease to the point where some post-war car designing can be done. But certainly that time is not yet here.

Many Factors Set Design What the "car of the future" will look like and what it will contain no man knows. Its development will depend to a considerable extent upon three factors: 1—The use of high octane gas, 2—the greater utilization of rubber, and 3—employment of light metals. One automotive executive points out that the automobile industry will be the greatest potential customer for aluminum after the war. But how much aluminum the industry will use will be determined by the price.

One interesting point to bear in mind: If the national income of the American people can be maintained anywhere near the levels that the government, industry and the public are talking about (say $100,000,000,000 a year or better), automobile production will exceed by some 30 percent or more all previous peaks. Incidentally, the industry is not at all worried about private plane competition. That is something, it believes, for the rather remote future.



Deadly Flivver—Constructed almost wholly of equipment and materials made in plants of the Ford Motor Co., M-4 32 ton tanks are pictured coming off of one of the tank assembly lines at a Ford plant

Auto Tooling About Complete Automobile companies are keeping their eyes on the plane expansion program and are contracting for die and tool capacity in

Detroit district shops. This program should keep the independent shops busy during the first quarter. On the other hand, the Tooling Information Center, started by the Automotive Council for War Production, reveals that more and more deliveries can be made in from three to six weeks. The black dot on the Centers chart, indicating deliveries over 10 weeks, is becoming less and less noticeable.

Tooling is far along in almost all automotive plants. Widespread cancellations by the Ordnance Department of the Army have adversely affected tool shops. Speaking for General Motors, President C. E. Wilson says that "Our biggest model change in history is at an end." Mr. Wilson believes, however, that new military projects, as well as retooling to increase production and improve the quality of war goods, will aid the demand for machine tools.

General Motors history in retooling is interesting. In two and a half years the corporation ordered 49,087 machine tools. So far it has received 37,878, still lacking 11,209. The job, therefore, is about three-fourths done. General Motors is receiving new tools at a rate of 2,500 to 3,000 units a month. In the next three or four months it should be well caught up on its machine tool requirements. The corporation does not expect new contracts or more plant expansion in 1943.

Jeep Jumpers — A female battalion prepares to spring into action, installing the wiring systems, safety belts, seats and the maze of fittings that go into the Army's reconnaissance cars. Known as the "metal mustang," the jeep has won army men's approval. When peace comes, it is expected the jeep will find use as a farm tractor. Picture was taken in the Willys-Overland plant

Auto Producers' Hiring Rises Manpower shortages are not seriously bothering General Motors. Peak employment is looked for in the latter part of this year. Most automotive companies have located new facilities near good labor markets. Car makers bemoan the lack of skilled help, but are reconciled to that situation and have stepped up training programs to keep pace with the climb in employment needs.

General Motors now has 288,542 hourly rated employees and 63,136 salaried workers on its payrolls. By the end of 1943 the number will increase to 427,909 hourly and 70,002 salaried workers. The small addition to the salaried ranks indicates that the corporation expects less paper work and planning in the final stages of its war contracts than at the beginning.

The Manpower Stabilization Program inaugurated in the Detroit area has had little effect on the larger companies. The smaller manufacturers are believed to have initiated the stabilization scheme and are benefiting from it. A War Manpower Commission official is not too optimistic regarding the working of the program. He calls the situation "confused."

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

COBALT—This steel alloy has been placed under tighter control by curtailing its use in certain specific items. Permitted uses include high-speed steels, laboratory and research equipment, magnets, non-ferrous alloys on orders rated AA-5 or higher, and in pigment for glass for optical and safety purposes. (Preference Order M-39.)

CONDUIT & METALLIC TUBING—Amount of steel that can be used in flexible metal conduit and tubing and metal raceways for inclosure of wire and cable has been restricted as well as sales. (Limitation Order L-225.)

ELECTRIC MOTORS & GENERATORS—February 1, 1943 has been established as the date upon which restrictions on deliveries of these items become effective. (Amended Conservation Order L-221.)

ENAMEL—Restriction on the use of several materials, governed by allocation orders, used in drum exterior coatings, closure enamel and can enamel has been revoked. (Revocation Conservation Order M-108.)

FURNACES—All further production of steel furnaces for direct-fired air heating systems has been ordered discontinued except for urgent military needs. (Supplementary Limitation Order L-22A.)

GEARS & SPEED REDUCERS—All types have been priced under Maximum Price Regulation 136, as amended. Gear makers under the machinery regulation are exempt from price control on developmental or secret contracts or subcontracts entered into with the government or agent.

HEAT RESISTANT STEEL—Delivery to AA-5 or higher rated orders has been restricted. Orders, if approved on form PD-391, can be completed even if rated lower than AA-5. (Interpretation Supplementary Order M-21-d.)

IMPORTS—A revision has been made to tighten control of strategic materials and now includes materials on Lists I and II. (Amendment to Imports Order M-63.)

MACHINE TOOLS—Standard definitions used in other price measures covering machinery, machine tools and machinery parts have been incorporated in Revised Price Schedule 1. Major change is elimination of welding equipment from scope of the schedule. Both new and used machines for joining metals are now brought under control of Maximum Price Regulation 136.

SPARE PARTS—Exemption of general industrial equipment for certain repair and maintenance purposes from the control over distribution does not apply to such parts for new equipment. (Interpretation 2, Order L-123.)

TOOL STEEL—A new order issued has established control of production of carbon and alloy tool steels. Producers most submit melting and delivery schedules for approval of Director General for Operations. (Amended Conservation Order M-21-a.)

Plastic Research Fellowship Sponsored by Hawley Company

PITTSBURGH—On industrial fellowship, devoted to an investigational program of importance to our armed forces, has been founded in Mellon Institute by the Hawley Products Co., St. Charles, Ill., manufacturer of molded cellulosic and allied plastic products.

Dr. J. C. Williams, an alumnus of Oberlin and Iowa State College and a specialist in cellulose chemistry and plastics technology, has been appointed to the incumbency of this Fellowship. He will be assisted by Peter Shanta, a chemical engineer from the University of Pittsburgh.

WARTIME WASHINGTON

BY BLAINE STUBBLEFIELD

As Peace begins to rear its beautiful head over the rumor horizon, war goods producers begin to get the jitters concerning their big, specialized inventories. Wilson and Eberstadt are a scheduling team. War Manpower Commission considers union membership question

RFC May Buy Inventories With the threat of peace beginning to loom on the horizon, many war producers are becoming worried about the possibility of being caught with huge inventories of raw and in-process inventories. Just as, at the beginning of the defense program, it proved necessary for RFC's Defense Plant Corp. to assume the burden of ownership of most of the new production facilities, there are now indications that RFC may have to take title to some inventories. One such indication is WPB's instruction to RFC's Metals Reserve Co. to start stockpiling steel scrap.

Although there are a few piles of household scrap lying around courthouse lawns, there's no surplus of prepared steel scrap except in Los Angeles. Hence initial purchases will only run to 35,000 tons. But this first stockpiling operation does set up the machinery. Indications are that it won't be long before the machinery gets a workout. Steel companies are becoming hesitant to carry large inventories, and are likely to welcome a chance to throw the burden on MRC.

Similarly, WP is working out an arrangement under which RFC will take over the inventory burden of a greatly expanded zinc smelter. The smelting firm has to carry 30,000 tons of concentrates, enough to wipe it out if the war demand ended. Plan is for RFC to take title to all except a normal peacetime inventory.

Wilson's Work Further Defined WPB Production Vice Chairman Wilson's authority with relation to the services has been clarified in a series of orders supplementing the vague agreement of early December. The orders give Wilson full responsibility and direction over scheduling military production to insure that schedules don't conflict, are in balance, and are consistent with production possibilities. He's empowered to demand any information he wants as to war production or procurement, to consult direct with producers as well as with service officials.

The line of demarcation between Wilson and Eberstadt is somewhat clarified by the orders, which give Wilson control over preparation of schedules and claims for materials submitted to Eberstadt. Eberstadt may hack the schedules down to make them fit material supply. Thereupon, it's up to Wilson, with Eberstadt's advice to readjust the schedules.

Personal relations between the two men have become warmer in the last few weeks. By solving some tricky technical problems in expanding material supply, Wilson is making himself indispensable to Eberstadt.

Won't Require To Join Union If the Manpower Commission compells a worker to take a war job in a closed shop industry, does he have to join the union? WMC has never yet actually forced anybody to take a job anywhere, so the issue hasn't arisen. Manpower officials don't think the issue is ever likely to become a serious one; though most of the war industries are organized, few of them have the closed shop. Nevertheless, lots of people who think the closed shop is wicked have been worrying loudly as to what will happen when manpower controls get tighter. Therefore, McNutt's labor-management advisory committee will probably issue a statement soon on the subject. Chances are, the statement will ask unions to follow an open-door policy on membership, perhaps to waive initiation fees, possibly to adopt some sort of work permit scheme for diehard non-union men who don't want to join.

Rubber Plants Get AAA Rank Secretly, WPB has given super - AAA priority to construction of 100-octane gasoline and synthetic rubber plants. The "special direction" system set up early this month without any public notification is also designed to clear up the competition between the gas and rubber plants, which use almost identical equipment. Under the new system, the 56 projects are arranged in order of urgency and each receives a Special Direction with a pulling power corresponding to its place on the list. Any Special Direction takes precedence over any priority rating, even an AAA. Sole exception is existing AAA ratings calling for delivery before Jan. 10.

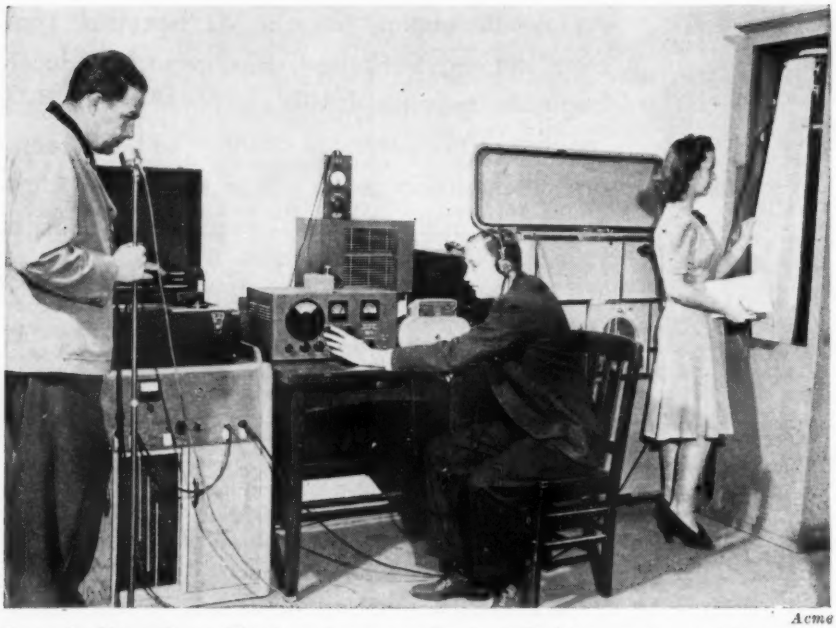
Would Cut Army Procurement The battle on the Washington front of civilian vs. military control is on full tilt, despite the fact that on the surface peace once again prevails. A group of powerful and determined members of Congress are ready to push the bill for establishment of the Office of War Mobilization. This bill, among other things, removes the control over procurement from the armed services and places it in civilian hands. Such removal is bitterly opposed by the armed services, even to the point where an organized effort is being made to win public support.

CMP Only for Basic Items There is no intention of extending the Controlled Materials Plan to all materials. It certainly won't go beyond the major basic materials. Five new claimant agencies have been created under CMP: rubber, agriculture, housing, petroleum and transportation. That raises the number of claimant agencies to twelve. The British have twenty-three, which WPB thinks is too many.

Railroads To Be Cared For Railroads, pleading for replacement equipment for '43 and unable to get WPB to allow more than very limited material thus far for new freight cars and for new locomotives, will be taken care of, though (as one official put it) the railroads "are no particular sweetheart." Certain Washington authorities privately accuse the railroads of being extraordinarily extravagant in cross hauling, in circuitous hauling and in running parallel trains. These authorities assert that the carriers agreed to substitute wood for steel only after a first-class battle. The new gondola cars, for example, are to have wooden floors and sides.

The record established by railroads in this war emergency, on the other hand, is in fine contrast with what happened in 1917-1918. Freight congestion has been held to a minimum, despite the load thrust upon the railroads, and at least some carriers are actually looking for business. Never have there been fewer cars awaiting repair. War goods carried to Atlantic ports have been handled with remarkable speed. Yet almost all the roads are operating with smaller track maintenance forces. One important road has 6,000 unfilled jobs for experienced men. This particular road has ten percent of its workers in the armed forces.

In recent months, tank cars have hauled less oil to the East Coast: thousands of decrepit, long idle cars, pressed into emergency use, need repairs.



Acme

Speeds Warplane Tests—A new radio test flight recorder perfected by engineers of Vultee Aircraft Corp., Downey, Calif., checks all reactions of an airplane during its test flight and radios them to recording devices on the ground. The inventor, Harvey Giffen, center, and assistants are shown checking the progress of a new plane in flight 100 miles from the laboratory

CMP Is Embarking on its Custom-Built Era: Alterations Will Be Made to Fit Blocs

WASHINGTON—Don't tear up your copy of Maximum Price Regulation 136, but you can safely figure that Leon Henderson's resignation from OPA marks the end of hard-boiled thoroughgoing control of prices. OPA will continue to function. Prentiss Brown, the new price administrator, will issue price orders, will do a certain amount of enforcement. But from now on the tendency will be upward. No price ceiling that squeezes anyone very hard will last.

Prices of industrial goods, as opposed to consumer goods, will not feel an immediate effect, but this is what you should expect: Early and substantial increases in the price of farm commodities, with a consequent upsurge in the cost of food. To nothing is labor as sensitive as to the price of food. The inevitable result will be a breakdown in the wage stabilization policy. Wage levels will be bound to rise above the Sept. 15 base at which they are now theoretically frozen.

Hold Your Hats, Boys!

With rising wages will come increases in price ceilings all along the line. This in turn will raise the value of parity, to which farm prices are geared; food prices will go up again, and the spiral is underway.

In addition to this levering upward from the farm, prices will be aided to rise by a much more "reasonable" attitude in OPA itself. The new price administrator will be much more receptive to appeals from businessmen for relaxation of ceiling orders.

This forecast is based on the causes of Henderson's ouster. Fundamentally the public—farmers, business, labor—would rather have inflation than undergo the hardships of an inflation-control program. Everyone would like to see other people's prices controlled, but nearly everyone is convinced that he can manage to come out on top in the inflation game. Reenforcing this basic pressure was Henderson's belligerent personality, which made him unpopular with Congressmen, and the clumsy handling of fuel oil rationing, which had raised a howl from all over the country.

The Farmers Did It

It was the farmers who really pulled price control down. But they couldn't have done it alone. The Congressional farm bloc took a licking last September when its efforts to put an upward revision of parity into the price control law failed. But the November elections convinced most Congressmen that nowhere in the country was there any real support for anti-inflation measures. With the resulting added support, the farm bloc threatened—and had the strength to do it—to revise parity ten percent up and to refuse appropriations for OPA unless the administration abandoned Henderson—and abandoned price control.

Urged by Conservation Order Sale and Use of Idle Motors

WASHINGTON—In an effort to put every usable motor in the country to work producing war materials, the WPB is appealing to manufacturers who have idle motors to make them available for sale, and to all manufacturers to use their motors to best advantage and for as long as possible. The appeal is part of the recently issued General Conservation Order L-221.

Ninety-five percent of the weight of every motor is iron, steel, aluminum and copper, the four critical and basic materials, allocated by CMP for only the most essential purposes. The other five percent is largely of equally scarce materials.

WPB officials say that many motors have been left idle during the conversion to wartime production, and that many producers are hoarding motors for possible emergencies or expansions, or have installed new equipment to replace broken down motors that could be repaired.

Under the recent order, all purchasers desiring new motors must certify to the motor manufacturer from whom they are ordering that they have no idle motor in their possessions which can be adapted; that they have attempted to obtain a used motor from at least three dealers; that the motor is not being purchased for replacement purposes; and that it is required for immediate use.

The purchase of replacement motors requires specific approval by the War Production Board, granted only when repairing is impossible and used equipment unobtainable.

When a producer cannot find used equipment, he is urged to make known his needs to the Electrical Equipment Branch, one of whose functions is to assist purchasers in locating hard-to-find types of motors.

Manufacturers who have idle motors in their plants should sell them to war plants or used equipment dealers, or inform the General Industrial Equipment Division of the War Production Board of their availibility.

NEW PLANTS BEAT OLD RATE

WASHINGTON—One Washington explanation of why new war production facilities have been so greatly overbuilt: the number of factories needed was figured originally on the known production per man in each war item to be manufactured. Since output had been on a small scale, new methods in new plants on a mass production scale sharply cut production time. The result was a substantial reduction in the capacity required (which was an accomplished fact after many unneeded facilities were already being constructed).

THE AIRCRAFT HORIZON

Bombers and troop transports now being developed promise to dwarf the existing big planes. Higgins Aircraft, Inc. is to build 1,200 C-76's, producing its own plywood therefor. The Focke-Wulf 190 has been found to have been over-rated.

The B-17 is little, and so is the B-24—Boeing and Consolidated four-engined heavy bombers respectively—as Air Force Chief Gen. H. H. Arnold recently said in an address. The General was referring to the huge new B-29, under development by Boeing this past two years or more. The War Department has clamped the lid on this airplane tight. Nothing at all specific can be said about it until further notice, which means until the enemy gets possession of it. A newspaper man who caught a glimpse of the B-29 at Seattle said that it "dwarfed the B-17." Months ago, when super-bombers were openly discussed, the plan called for a 50-tonner. But the size may have been increased; it may be twice as big as the B-17. If so, it is not much short of the Douglas 70-ton B-19, which everybody has seen in the movies. Only one B-19 was built, because, at the end of the four or five years it was building, its performance was obsolete. The same was true of the Martin 70-ton Mars.

Another behemoth now in the works is Consolidated's 400-passenger troop transport for the Army. Unofficial information is that the President, upon the advice of United Nations' high command, asked for a big troop carrier, and the Army Air Force wrote up the specifications. These figures are known in the industry but they can be published only roughly. The Army asked for a net load of about 30 tons, a range of 10,000 to 20,000 miles, and a speed equal to that of many medium bombers. More than one big-plane manufacturer figured on the job, and they arrived at widely various gross weights; one is said to be as high as 600,000 pounds. It can only be said that the building of this plane will require some long engineering steps from existing craft. The companies that figured on it say it can be done but it will be a hard job. Members of the industry say that Consolidated hired Bill Stout, designer of the Ford tri-motor transport of the late 1920's and early 1930's, so that he could contribute to the design of the troop transport.

Most of the fiction about the Higgins cargo plane project has now been replaced by facts. The Army has announced a contract with Higgins of "more than" $5,000,000. This is chicken feed, and probably represents only an initial allocation for development work.

In a letter to McGraw-Hill publications, Col. John H. Jouett, director of Higgins Aircraft, Inc., says the company has a signed contract for 1,200 C-76-H-1 airplanes, powered with two 1830 Pratt & Whitney engines. "We are building exactly to the Curtiss design," he says, "with no modifications of our own." On Dec. 14 the company was negotiating with the Defense Plant Corporation for construction of a plant at Michoud, in suburban New Orleans, site of Higgins' abandoned Liberty shipyard.

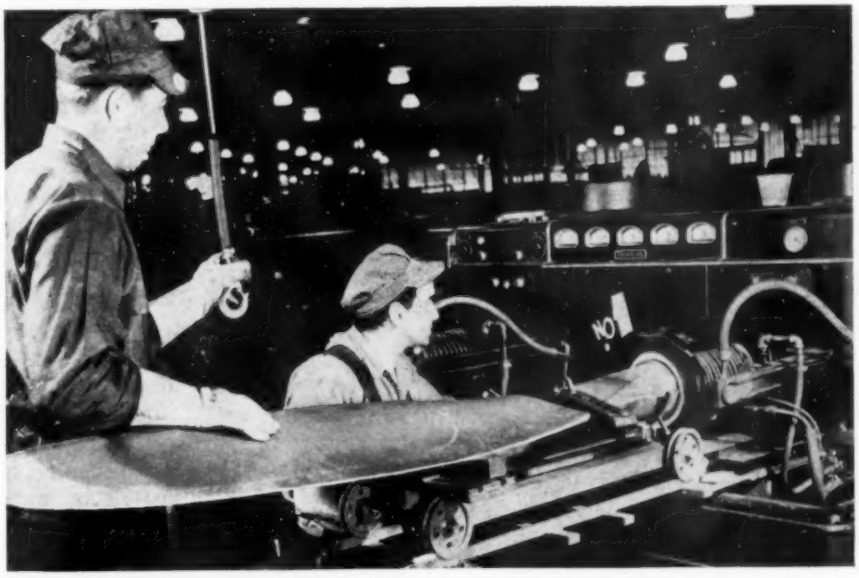
In reply to questions, Col. Jouett wrote that the company would be able to produce its own plywood. "The whole Higgins industries is thoroughly familiar with the use of plywoods, and experienced in their manufacture and treatment." Company expects to start production in about six months.

The C-76, built almost entirely of plastic-bonded wood, has a wing span of 108 feet, length 65 feet, gross weight somewhere around 25,000 pounds, or about the size of the DC-3 you ride on the airlines. It has been accepted by the Army but changes may be necessary as the plane gets its real shakedown in service. Wooden planes were used during the World War and ever since, but the bonding agent has been vastly improved. At first it was plain glue.

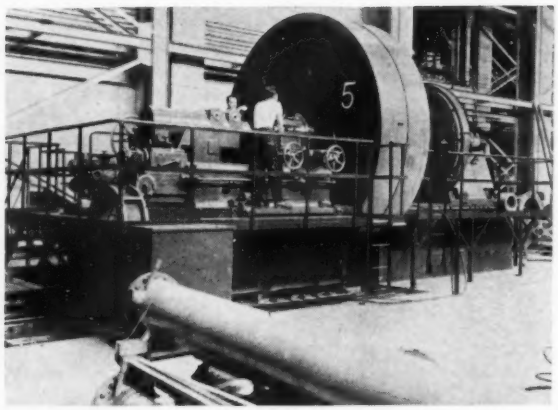
Focke-Wulf out of race, says a British press release. This statement is more wish than fact, for the Nazi Focke-Wulf 190 fighter will destroy a lot more life and property before it is through. Actually, the 190 is on its way **out.** The RAF has at last got hold of one, intact, and tested it thoroughly. The FW-190 is not the high flying, fast fighter it was thought to be. Its effective height is only 18,000 feet, and its speed falls off rapidly above 20,000. This of course is due mostly to lack of adequate supercharging—the problem of all air forces in the new high altitude air war. The British, who practically saved their hides back in blitz days with the wonderful Spitfire, have again topped the world by powering it with the Rolls-Merlin 61 motor, which turns up about 2,000 horsepower. Due to superior supercharger facilities, this engine gives the Spitfire snappy performance up to nearly 40,000 feet. The other day one of them attacked a Nazi Junkers observation plane considerably above that height. But height is not everything, as our P-40s and P-39s have demonstrated.

Saving of six months in preparation to turn out torpedo bombers for the Navy is expected to result from the use of an Allentown, Pa., plant of the Mack Truck Company. The announcement was made by Charles E. Wilson, production vice chairman of WPB. The plant will be in full operation in 1943.

Accident rate in the aircraft industry in 1939 was about 15.3 per 100,000 man-hours, considered pretty good by the underwriters. The Aeronautical Chamber of Commerce figures that in 1942 the rate reached less than half of the previous 1939 figure. As things now stand, an aircraft worker has one chance in 300 of meeting with an accident in any given week.



Quick High Heat—Propeller blade shank being heated to 2,200 F. in 210 seconds prior to upsetting—the second of two induction heating operations accomplished on a compact TOCCO machine



Jumpin' the Gun—Told machine tool builders were too busy to build a 200 in. gap lathe, General Electric built one to turn marine reduction gears. Some novel departures expedited building: for instance, use of concrete in place of steel for the base saves months

More Nickel in Scrap Gets NE Specifications Changed

WASHINGTON—Modifications in the National Emergency steel compositions made necessary by unexpectedly greater amounts of nickel content in scrap now available, were approved by representatives of the War Production Board, the Technical Committee on Alloy Steel of American Iron and Steel Institute and the Iron and Steel Division of the Society of Automotive Engineers.

The average nickel content of scrap has been steadily increasing, due partly to the influx of new nickel-containing steel scrap generated as a result of ever-increasing production of war materials, and partly to the conservation measures employed by steel mills.

Consequently, many steel mills find it virtually impossible to hold the nickel content of some of the NE steels below 0.60 percent as originally specified for many grades. There is not available efficient carbon steel scrap low in phosphorus and sulphur content to dilute the high nickel scrap, and it is commercially impracticable to reclaim the nickel for any other use in any other manner.

To alleviate this situation, and to make more efficient use of the alloying elements derived from scrap, the following revisions in the list of National Emergency steels have been made:

The following compositions have been been deleted: NE 8022, 8339, 8949, 8715, 8722, 8735, 8739, 8740, 8744 and 8749.

The NE 8600 series has been extended to compensate for the deletion of the NE 8700 series by the addition of the following compositions: NE 8635, 8637, 8640, 8642, 8645 and 8650.

Plastics Will Supplement Metals, Not Replace Them

EAST PITTSBURGH—Plastics and metals will be partners rather than competitors after the war and the combination will enable engineers to build machinery and other structures once considered impossible, according to Dr. A. Allan Bates, manager of the Chemical and Metallurgical Department of the Westinghouse Research Laboratories.

Both types of materials, says Dr. Bates, have inherent advantages and disadvantages that bar any complete replacement of one by the other.

Some partisans claim plastics and synthetic resins eventually will be used for everything except food. But there are innumerable articles that will be metal for years to come—automobile crankshafts and valves, electric transmission lines, blast furnaces and electric motor armatures are examples of these. Plastics burn or melt at temperatures that have little effect on most metals. And plastics are not useful as conductors of electricity.

Ease Cutting Tool Limits

WASHINGTON—A purchaser may obtain preferential delivery of certain special cutting tools up to the lowest quantity that can be efficiently produced by the manufacturer, according to a provision of General Preference Order E-2-b as amended by the Director General for Operations.

The present amendment changes the original order restricting the purchaser to three sets of special cutting tools, and provides that he may accept deliveries of the "producers' minimum practicable manufacturing quantity." Where the quantity is less than three sets of special tools, the purchase may be extended to this amount. In no event, however, can the purchaser obtain more than a 90-day inventory.

The amendment is designed to overcome certain minor difficulties which developed in operating under the original order. Among the changes made are:

A provision that frees purchasers of cutting tools from the necessity of filing an endorsement, where they are delivered with a larger machine to make it usable and are acquired under an authorized purchase order.

A provision that makes hard alloy blanks or tips subject to the provisions of the original order, whether or not attached to the tool shank.

Nutrition on Wheels—Properly balanced diets including nutritious hot foods and drinks, prepared by an expert culinary staff in kitchen at the Lodge & Shipley Machine Tool Company, are brought to workers in a "rolling cafeteria" right alongside machines. By means of this service, workers are able to eat hot lunches without losing time, and thus get extra income and production, as the "machine-side lunch time" goes on with full pay. Workers Howard Lauders, Otto Hoog and Amos Lowe are shown making their selections from the portable steam table that constitutes the cafeteria

NAMES in the NEWS

B. D. Kunkle, vice president in charge of the manufacturing staff of General Motors Corp., has also been named group executive over Cadillac, Oldsmobile, Pontiac, Canadian and Overseas Divisions, and W. S. Roberts has become his assistant. William A. Wecker, who has been president and general manager of McKinnon Industries, subsidiary of General Motors Corp. at St. Catharines, Ont., has been named vice president and general manager of General Motors of Canada. Thomas Cook succeeds Mr. Wecker as president and general manager. D. U. Bathrick will assume charge of the Washington office of General Motors Corp., succeeding R. H. Grant, vice president who is returning to Detroit to resume his former duties.

Dean M. Warren has been transferred from the General Electric Nela Park office, where he has been in charge of technical publicity, to the lamp department at Buffalo and will devote full time to wartime lighting of industries in that area.

John H. Romann, chief metallurgist of Tube Turns, Louisville, Ky., was recently appointed chairman of a committee to conduct a special nation-wide investigation in industrial plants on low temperature properties of metals. The research work is being carried on for the War Dept. by the War Metallurgy Committee of the National Research Council, National Academy of Sciences, Washington.

Albert C. Delmont has been appointed research director of the newly organized research and laboratory departments of Douglas T. Sterling Co. of Stamford, Conn. Mr. Delmont has specialized in modernizing shop methods, and will devote his efforts to post war planning to assist manufacturers in investigation of facilities for the making of post war products.

George B. Wadlow, connected with Continental Roll & Steel Foundry Co. for more than 25 years, has been named assistant to the president of the Continental Ordnance Corp., a subsidiary company.

Earl S. Patch has been named mechanical engineer in charge of application engineering of Henry L. Crowley & Co. Mr. Patch was formerly sales manager of the Moraine Products Div. of General Motors Corp. He will serve as special consultant to the War Department on powdered metallurgy and allied problems.

Frank A. Mickle has been granted a leave of absence by the University of Michigan and has been appointed chief of the simplification section in the Development Branch of the Ordnance Department Tank-Automotive Center in Detroit.

Receive General Motors Canadian Appointments

B. D. KUNKLE

W. S. ROBERTS

WM. A. WECKER

B. DeLorenzo has been appointed manager of the heat transfer department of Brown Fintube Co. of Elyria, Ohio. Since 1936 he has been design engineer for Foster Wheeler in the oil division, specializing on heat transfers and flows of fluids.

J. H. Cooper has been given leave of absence as welding engineer for Taylor-Winfield Corp., Warren, Ohio, to become chief of the Resistance Welding Section, General Industrial Equipment Div., War Production Board.

H. Warren Hem has joined the Howe Scale Co. of Rutland, Vt., as research director. He began his business career with the Strait Scale Co. of Kansas City in 1909 at the machinist's trade, and later supervised pattern, foundry and machine work as well as scale design. He has been recently identified with the Toledo Scale Co. in the engineering department.

Arthur V. Wiebel, who has been serving as executive consultant to the Steel Div. of WPB for the past year, has resigned to return to his post as assistant vice president of United States Steel Corp. of Delaware.

Ralph Strang has recently joined Morey Machinery Co., Inc., of New York City as head of the sales engineering department. Mr. Strang was previously chief of the research service unit, Facilities Branch of WPB.

Arthur A. Turton has been appointed chief engineer of Harvill Corp., Los Angeles. He has been in charge of research and development as a consulting engineer for the company for about a year. His former connection with the aircraft industry has been with Boeing & Beech, Curtiss-Wright, North American Aviation, Inc., and Lockheed Aircraft & Aircraft Accessories where his duties involved all phases of aircraft engineering.

Robert H. Bishop, formerly eastern sales manager of the Lighting Division of Sylvania Electric Products, Inc., has been promoted to the post of general sales manager of this division with headquarters in the New York office.

John E. Neumann has been named president of Anderson Stove Co., Inc., of Anderson, Ind. Wilbur J. Birkenmeier has been elected vice president and Marion Collins has become secretary-treasurer.

Alfred Marchev, vice president and assistant general manager of Republic Aviation Corp. of Farmingdale, L. I., has been appointed general manager of the Farmingdale plant. He joined the corporation early in 1942 and prior to that was chief engineer, works manager and director of Signode Steel Strapping Co. of Chicago.

Martin A. Hotham, formerly connected with American Tube & Stamping Co. of Bridgeport, Conn., has become production engineer of Follansbee Steel Corp., Follansbee, W. Va.

N. M. Forsyth has been made vice president in charge of sales, Pump Engineering Service Co., division of Borg-Warner Corp., Cleveland. He was formerly general sales manager.

D. P. Brannin, previously in charge of metal sales for New Jersey Zinc Sales Co. in the Chicago area, has been appointed district sales manager of the Pigment and Metal Sales Divisions with headquaters in Chicago. D. P. Dunphy has been made district sales manager of the Pigment Div. in New York.

Roger W. Allen has been named southeastern district manager for Wheelco Instruments Co. of Chicago.

Becomes Vice President *Heads Purchasing* *Operations Manager*

A. R. ABELT

C. D. BUCHER

H. G. SMITH

He will make his headquarters at 305 Techwood Drive, Atlanta.

A. R. Abelt has been appointed a vice president of Chain Belt Co. to succeed the late F. J. Weschler. Mr. Abelt joined the organization in 1907 and has served in production, sales and executive capacities. In 1922 he was made sales manager of the Transmission Div., and early in 1942 he became manager of that division. Since 1930 Mr. Abelt has been secretary of the company.

C. D. Bucher has been appointed director of purchases for Dayton Rubber Mfg. Co. to succeed J. C. Cunningham. He has served two of the large rubber companies in the capacity of purchasing agent and buyer of engineering materials.

Harry G. Smith has become operations manager of the Aircraft Parts Div. of Reynolds Metals Co. and will superintend the opening and operation of five additional plant buildings and will make his headquarters in Louisville, Ky.

C. R. Dobson has been appointed chief industrial engineer of Jones & Laughlin Steel Corp., Pittsburgh. Since 1930 Mr. Dobson has been assistant to Mr. Stone who recently resigned.

W. F. McGuinness, treasurer of Elastic Stop Nut Corp., has also been named vice president. He has been associated with the corporation since 1934, and formerly an executive of the American Gas Accumulator Corp. William H. Knight, at one time with Firestone, has been named director of sales and market research.

Albert W. Davison has joined Owens-Corning Fiberglas Corp. as scientific director of the research laboratories in Newark, Ohio. Dr. Davison has been head of the industrial engineering curriculum at Rensselaer Polytechnic Institute since 1935.

OBITUARIES

Charles A. Kropp, 77, chairman of the board of the Kropp Forge Co. and Kropp Forge Aviation Co., Chicago, passed away at his winter home at Miami Beach, Fla. He organized one of Chicago's earliest job forging shops in 1901 and was widely known in the steel industry and metal-working trades. The forerunner of the present company had its roots in Annefors, Sweden, where Mr. Kropp learned his trade.

CHAS. A. KROPP

Edward H. Sapp, 70, consulting engineer of the New York Shipbuilding Corp. at Camden, died in New Jersey recently.

C. C. Dornbush, 67, for 40 years sales engineer of Jones & Laughlin Steel Corp., Pittsburgh, passed away recently.

Clarence Bergman, 45, died recently. He was vice president of the Sterling Automotive Manufacturing Co. of Chicago. He had been sales manager for Beckley-Ralston Co. and sales representative for many manufacturers of automotive specialties.

John C. Scheeler, president of the Buffalo Wire Works Co., and vice president of Buffalo Galvanizing and Tinning Works, died in Buffalo recently at the age of 55.

H. E. Richardson, Philadelphia sales manager for Youngstown Sheet & Tube Co., recently died in that city at the age of 57. He had been connected with the company for 29 years.

Albert F. Corbin, former president of Union Mfg. Co. of New Britain, Conn., died at his home at the age of 76. He began his business career with the P. and F. Corbin Co. in 1882, and later became superintendent of the Corbin Cabinet Lock Co. In 1905 Mr. Corbin joined his brother, serving as vice president and general manager of the Union Mfg. Co., and president since 1908 until his retirement in 1929.

Louis La Badie Driggs, 74, who headed the Driggs Ordnance and Engineering Co. during the first World War, died at his home in New York City. He designed a gun now used by the Navy.

William F. Cole, 83, who was vice president of the Baldwin-Duckworth Chain Corp. until his retirement a few years ago, passed away in Worcester, Mass., recently. For many years Mr. Cole was prominent in the elevator manufacturing field.

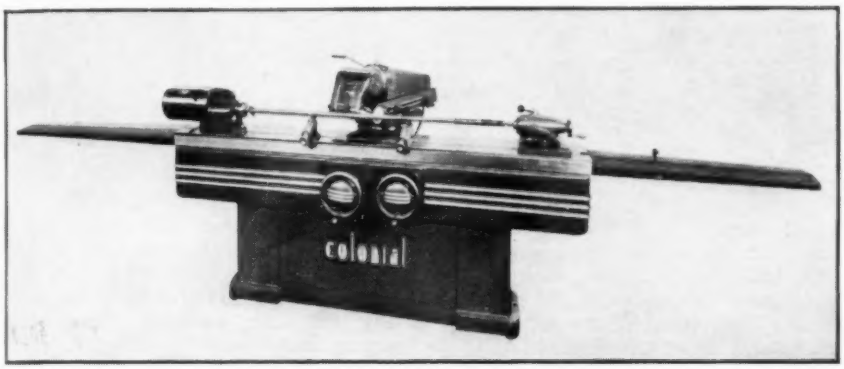
Edward Philip Linch, mechanical and consulting engineer and president of the Gem Stopper Co., died in Philadelphia recently.

Edward G. Watkins, 77, inventor of the Simplex time recorder, founder and president of the Simplex Time Recorder Co., passed away after an illness of three years. The National Association of Manufacturers presented him with an award two years ago for his contribution to the advancement of living standards by invention of the time recorder.

E. G. WATKINS

SHOP EQUIPMENT NEWS

Colonial Universal Broach Sharpening Machine Accommodates 6-In. Diameter Round or Flat Broaches



For sharpening round or flat broaches Colonial Broach Co., Detroit, Mich., has brought out a universal broach sharpening machine of streamline design. It accommodates flat broaches up to 65 in. in length between end teeth, and round broaches up to 72 in. between centers and 6 in. over-all diameter. With few adjustments the change-over can be accomplished from round to flat sharpening.

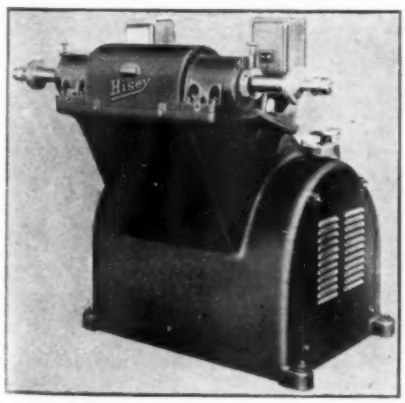
The over-all length of the working table is 99 in. and width is 11¼ in. It travels on one flat and one V-shaped way provided with dust guards at the ends. The maximum amount of travel of the grinding wheelhead is 12 in. A cross-slide providing a 10 in. travel is mounted above the graduated indexing support at the top of the vertical column.

A feature of the sharpener is the use of two handwheels to provide three movements of the wheelhead and work table. For cylindrical broach sharpening the headstock has a ⅛ hp. motor and reduction gearing. The speed change is actuated by a shifter lever contained in the headstock housing. The cross-slide handwheel on front of the machine is placed in the "out" position for grinding flat or surface broaches.

The grinding wheel spindle and headstock motors operate on 220 or 440 volts. Total space occupied by the sharpening machine is about 20×4 ft., and it weighs approximately 6,800 lb.

Hisey-Wolf Polisher and Buffer Has Motor Mounted Inside Base

A heavy-duty polisher and buffer has been announced by Hisey-Wolf Machine Co., Cincinnati, Ohio. The motor is mounted inside the base, permitting the use of standard open motors in place of totally inclosed, fan-cooled motors. The machine is built in the single spindle, single motor type, as well as the two spindle, two motor style, with motors from 3 to 10 hp. capacity. A feature of the constant level type oilers is oil lubrication with a minimum of attention. Encased type spindles can be furnished, with a housing about the spindle extension with ball bearing directly adjacent to the wheel.

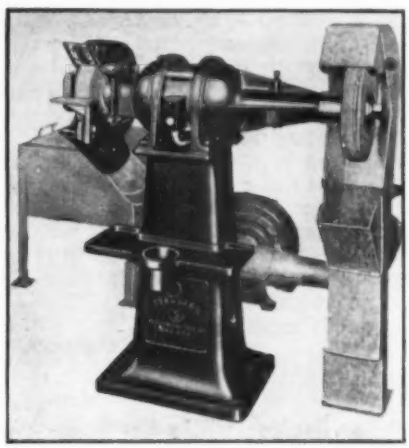


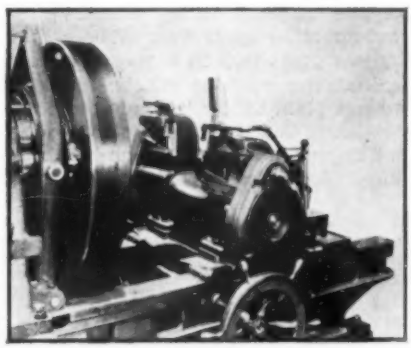
Standard Announces Machine For Grinding and Buffing Work

A combination grinding and buffing machine available in 1, 3 and 5 hp. sizes has been announced by Standard Electrical Tool Co., Dept. M, 2488 River Road, Cincinnati, Ohio. The left side has a safety hinge door emery wheel guard adjustable to wheel wear and fitted with adjustable spark breaker and work rest. An exhauster equipment is included for removing and collecting grinding and buffing particles.

The spindle is mounted in three heavy-duty ball bearings and the buffer is fully inclosed. A tool tray and removable water pot are fitted to the front of the pedestal.

The dust collecting system is available separately for application to any type of grinding, buffing and polishing equipment, and is made in three sizes. This system includes material handling fan, blower, air filtering stand and adjustable exhaust hood.





Landis Pipe Threading Machine Equipped With Cutting Off Unit

Announcement of a hydraulically-controlled cutting off unit has been made by Landis Machine Co., Waynesboro, Pa., to replace the standard carriage, cross-rail and diehead of the Landis mill-type pipe threading machine where that machine is to be used only for cutting off operations and maximum operating efficiency is desired.

This cutting off device comprises two

high-speed steel cutting off tools mounted in heavy slides. The slides function through a hydraulic cycle which provides rapid traverse of the tools to the work and rapid return after completion of the operation. A single lever controls both forward and return movements of the tool slide.

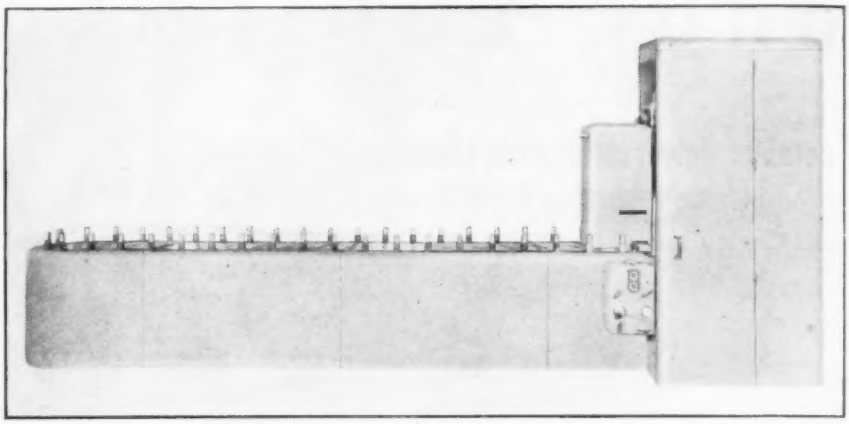
Operator control of the hydraulic cycle provides variable feed rates for the tools and adjustment of the length of travel for different thicknesses of tubing. The cutting off tool slides are likewise adjustable for various diameters of tubing.

Duramask Protective Coating Used On Paint Room Floors

A floor masking material for paint room floors called Duramask has been produced by Turco Products, Inc., 6135 South Central Ave., Los Angeles, Calif. It can be applied with a kalsomine brush and quickly dries to a hard, durable, non-skid surface. When the accumulation of paint on this protective coating requires removal, Duramask can be dissolved with water and the paint film can be mopped away.

This material can also be used to protect machinery, walls, work benches and other surfaces from paint, oil or grease spillage. It is non-inflammable and non-corrosive and said to be non-injurious to the skin.

DeVilbiss Shell Coating Equipment for Various Sizes Arranged for Automatic Spraying Inside and Outside



Shell varying in size from 20 to 155 mm. can be automatically coated inside and outside in the shell coating equipment announced by the DeVilbiss Co., Toledo, Ohio. Some types available spray exteriors only, while others paint both inside and outside. The machine will handle all finishing and coating materials usually specified for ammunition.

Spraying stations are located at one or both ends of the conveyor. On one type three stationary automatic spray guns are actuated only when each shell moves within spraying range. Another model employs two guns, one for the inside and the other for outside spraying, both of which are automatically moved horizontally and vertically with the shell. A third arrangement for shell having an inside adapter has a spray gun with a hook type extension. This and another moving extension gun coats all the interior surfaces while a third moving gun paints the outside.

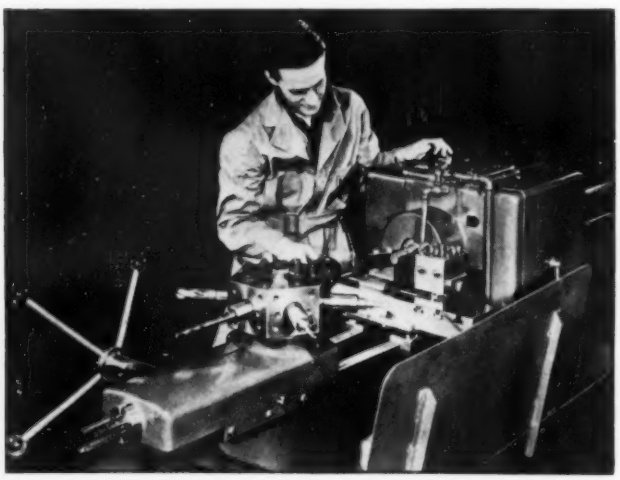
Oster Rapiduction Lathe Has Automatic Turret Indexing

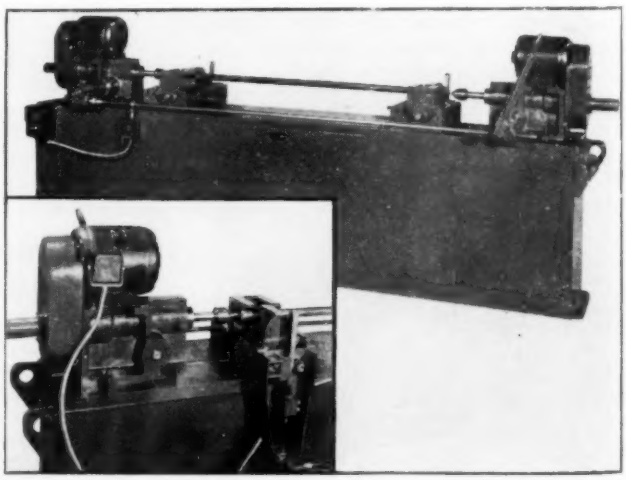
The No. 601 Rapiduction turret lathe produced by Oster Manufacturing Co., 2057 East 61 Place, Cleveland, Ohio, is now equipped with automatic indexing. The machine has a capacity of 1½ in. round for cutting off, boring, tapping, reaming, facing, threading and various other operations. Where three or less operations in sequence are required, the machine can be furnished with a plain saddle instead of the six-station turret.

The spindle is mounted on ball bearings. A belt-connected coolant pump is assembled in the machine base. The machine can be specified with a worm or direct drive to the spindle, a two speed motor, reverse, electric brake control. This lathe occupies a floor space of 33×70 in., without bar feed extension which requires 94 in. beyond the pan, and weighs approximately 1,700 lb.

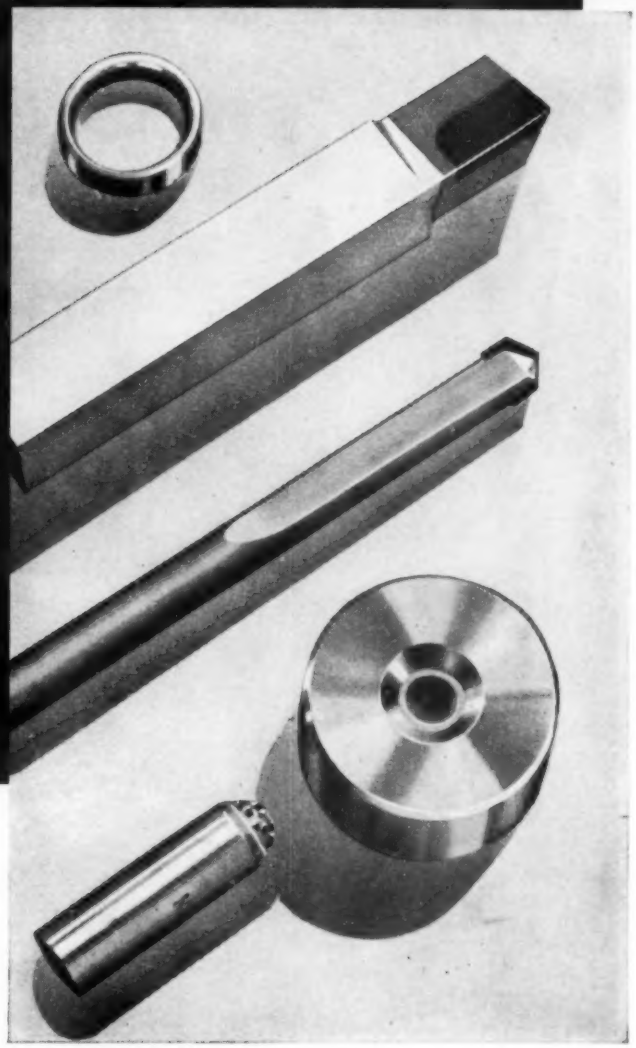
Pines Centering Machine Takes Bars Up to 6 Ft. Long

A two spindle automatic centering machine for bars up to 6 ft. long has been introduced by Pines Engineering Co., Aurora, Ill. One chuck and one head are stationary on the machine. The other chuck and head are movable to accommodate different lengths of bars. One chuck is removed from the machine for centering pieces from 18 in. down to 6 in. long. The chucks are both actuated by air cylinders directly connected through a rack and pinion on the screw for opening and closing the jaws. A cam on the lay shaft for advancing the spindles actuates a four-way solenoid operated air valve through a limit switch, closing the chuck automatically. The capacity of the chucks is a maximum of 5 in. diameter round bars.





Use all 5 Ways to STEP UP War Production . . . With Carbides



1. Cut Metals Faster! . . . Carbide tools commonly double the volume of metal removed per hour. Cut wide range of material, from "tough" armor plate to "soft" plastics. Continuous or interrupted cuts. Adaptable to most old machines, as well as new. (Catalog GT-142.)

2. Dress Grinding Wheels Easier! . . . Diamond-Impregnated Carboloy dressers make diamonds do a full day's work every day! No time out for remounting. No lost diamonds. No "pampering" temperamental stones. Diamonds held permanently in place. Stocked in 3 sizes for wheels up to 42" diameter. (Catalog GT-142.)

3. Keep Machines Running! . . . Stop "shut-downs" caused by excessive wear on such parts as rollers, cams, guides, gages, valves, etc., used on your equipment. Just a small insert of carbide at the point of wear often increases life of parts up to 100 times longer. (Booklet WR-101.)

4. Draw Metals Better! . . . Draw, size, extrude your metals through carbide dies for better finish, greater accuracy, larger output, more continuous operation. Use for wire, bar, tubing, sheet metal. Outstanding for cartridge cases from .30 cal. through 105 mm. (Manual D-113.)

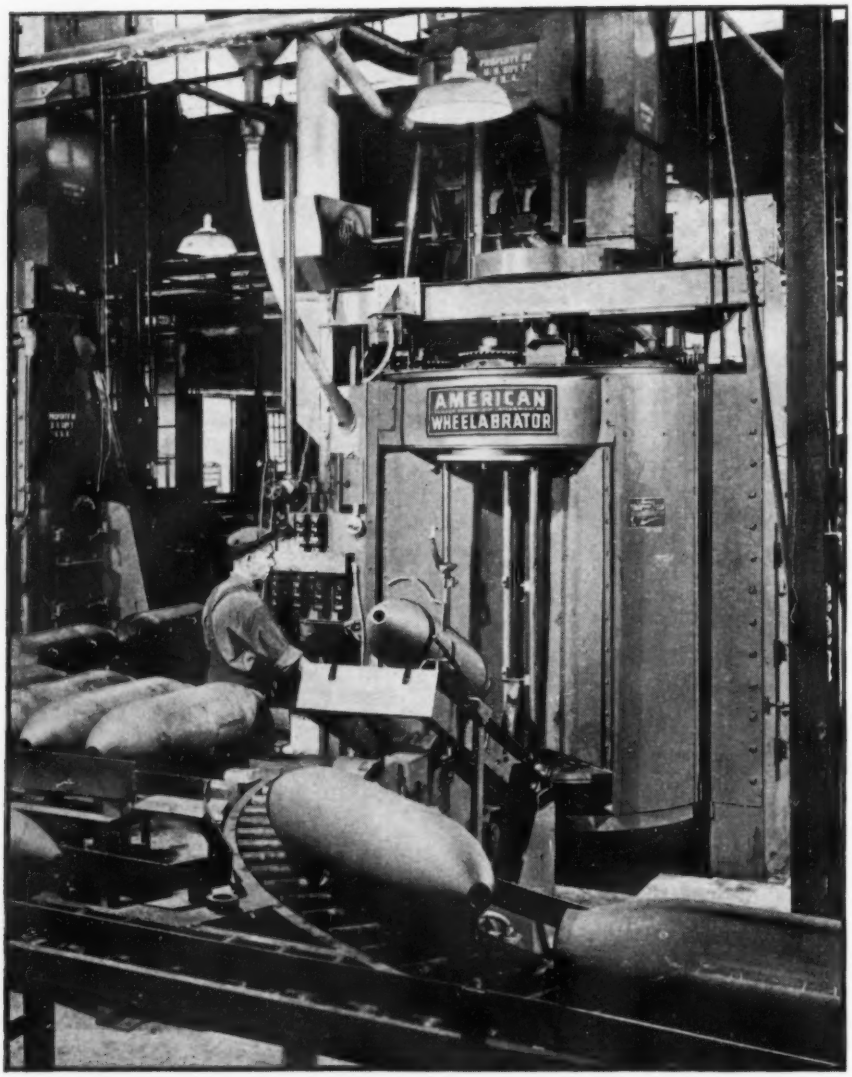
5. Install Equipment Quicker! . . . When installing new equipment, wiring and piping, or relocating present machines, carbide masonry drills drill holes 75% faster in concrete, brick, tile, porcelain, plaster. (Leaflet GT-103.)

CARBOLOY COMPANY, INC., 11149 E. 8 MILE BLVD., DETROIT, MICH.
(Sole makers of the Carboloy brand of cemented carbides)
Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Seattle
Canadian Distributor: Canadian General Electric Co., Ltd., Toronto, Canada

CARBOLOY TRADEMARK **CEMENTED CARBIDES** TRADEMARK

TOOLS • DIES • DRESSERS • CORE BITS • MASONRY DRILLS • WEAR RESISTANT PARTS

American Bomb Cleaning Unit Suitable for Variety of Sizes



A blast cleaning machine which cleans both the interior and exterior surfaces has been brought out by American Foundry Equipment Co., 555 Byrkit Ave., Mishawaka, Ind. An airless Wheelabrator unit is used for blast cleaning the exterior while compressed air grit blasting removes heat-treat scale from the large bomb interior.

Operation of the bomb cleaning machine is entirely automatic. From the conveyor line a bomb falls into a loading device which lifts the bomb into a hanger at the front of the machine. As the bomb passes into the blasting chamber it is indexed and rotated over a lance-type air blast nozzle which scours the interior of the bomb with steel abrasive. At another station the bomb is rotated in front of an airless Wheelabrator unit which cleans the exterior of the bomb. As the cleaned unit revolves to the front of the cabinet, it is removed and another placed in the hanger. The machine can be used for cleaning a wide range of sizes and types of shell with a few minor changes.

Salsbury Industrial Truck Available in Three Types

Announcement of a Salsbury industrial power truck available in lift, cargo and tractor types has been made by Nutting Truck and Caster Co., Faribault, Minn. Among the features of the turret truck are a fully automatic clutch, self-shifting transmission and the engine-over-drive wheel power assembly contained within a turret. The main frame of the power plant is mounted in ball bearings which allows steering in any direction over a 360 deg. arc. The turret and drive wheel are reversed in one and the same motion to reverse the direction of travel. Since the power turret is a completely independent unit, it can be easily removed for servicing.

The self-shifting transmission is automatic and provides infinitely variable drive ratios between 60 to 1 in low and 20 to 1 in high. The automatic clutch engages as the engine is accelerated and disengages when it idles.

The power specifications are the same for all three types of truck. The power plant is a single cylinder, 4 cycle, air-cooled engine and provides a maximum speed of 8 miles an hr. under full loads. The lift type is the Model SLT, the cargo type SCT, and tractor type STT.

Aget-Detroit Dust Collector Employs a Cyclone Filter Unit

A self-contained dust collector of the cyclone-filter type has been announced by Aget-Detroit Manufacturing Co., 2040 Book Bldg., Detroit, Mich. Its capacity of 1,250 cu.ft. per min, is adequate to exhaust dust laden air from large wheel buffers, polishers and grinders or from small wheel equipment when grouped. The compactness of this unit permits location immediately next to the machine to which it is connected.

This Model 1250 Dustkop employs a cyclone to collect a large proportion of the dust and dirt drawn in. In addition, a spun glass filter is employed so that air from the cyclone receives a further cleaning. Considerable heat is saved by returning the cleaned air to the working space. A multiple blade fan direct driven by a continuous duty 1½-hp. motor is used to pull the dust-laden air and send it up to the top of the unit where it enters the cyclone. The air then rises through the top and

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Photo Courtesy International Business Machines

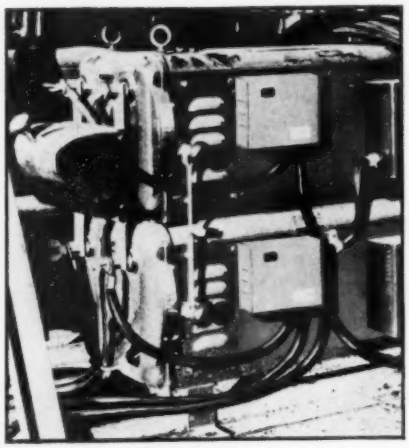
returns to the working space after passing through the drum-shaped spun glass filter. The Dustkop requires a floor space about 20×28 in. and over-all height is 62 in. The unit can be supplied with a motor for 60 cycle a.c. power, or for direct current operation.

Hewlett-Packard Starter Used With Motor-Generator Sets

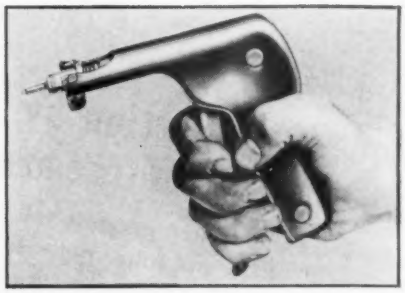
For operation in conjunction with any standard welding motor generator set, Hewlett-Packard Co., 395 Page Mill Road, Palo Alto, Calif., has introduced the Model 1010 automatic welding machine starter with arc-time totalizer. The relay control mechanism and time recorder are mounted in a rigid steel inclosure with enamel finish. The time recorder indicates the total elapsed welding time in tenths of an hour up to 9999.9 hr.

The automatic welding machine starter closes the magnetic starter switch when the welding rod is touched to the work. After a short interval of no welding the control automatically stops the machine.

This model can be mounted on any standard welding machine. Leads are provided for connection to the generator and terminals for connection to



the alternating current supply. It can be furnished for operation on 110, 220 or 440 volts 60 cycle, and for welding machines up to 400 amp. with open circuit voltage up to 110 volts.



Safety Champ Gun Designed For Assembling Skin Holders

Announcement has been made by Prestole Division, Detroit Harvester Co., Toledo, Ohio, of the Safety Champ gun used for assembling Prestite or other skin holders to aircraft sheets. The gun is light in weight, and the automatic gun-type grip provides for greater leverage. The use of hardened steel clips in the muzzle increases the life of the gun and provides greater safety because the clips grip the fastener around more than half its diameter rather than depending on point contact.

Wells Metal Cutting Bandsaw Cuts Metal In Most Any Shape

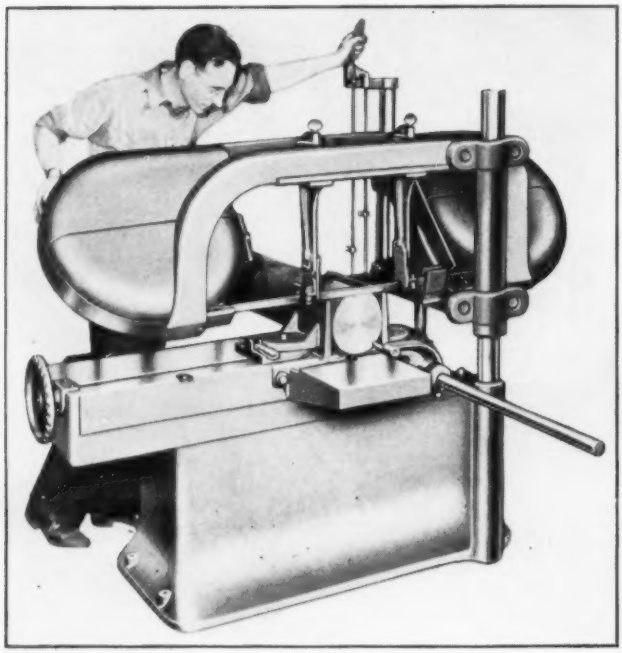
The Model V-12 metal cutting bandsaw brought out by Wells Mfg. Corp., Three Rivers, Mich., includes a hydraulically controlled feed and lift apparatus and does continuous metal cutting of most all metals in practically any shape. The machine is equipped with a ¾ hp. motor which drives the blade at speeds of 53, 94 or 148 ft. per min. It has a hand operated quick-acting vise, belt and gear drive and ball bearing support of moving parts.

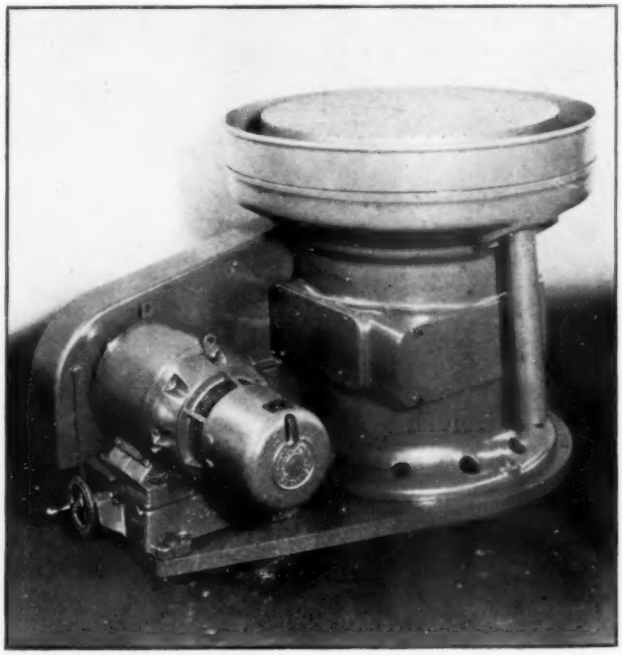
The V-12 has a capacity of 13×16 in. rectangular, and 13 in. dia. round. The over-all height is 52½ in. and the bandsaw occupies a floor space of 73×30 in. and weighs 1,750 lb.

Gardner Horizontal Lapper Available In Wide Size Range

A line of horizontal lapping machines ranging in 12 to 72 in. wheel diameter sizes has been announced by Gardner Machine Co., Beloit, Wis. A cast iron lapping plate grooved to form small squares and operating at slow speeds is employed in all sizes except the 53 and 72 in. These sizes have a standard steel wheel faced with a very fine grained abrasive disk as the lapping unit. They have a swinging bar type diamond dressing device for truing up the face of the lapping wheel quickly and easily.

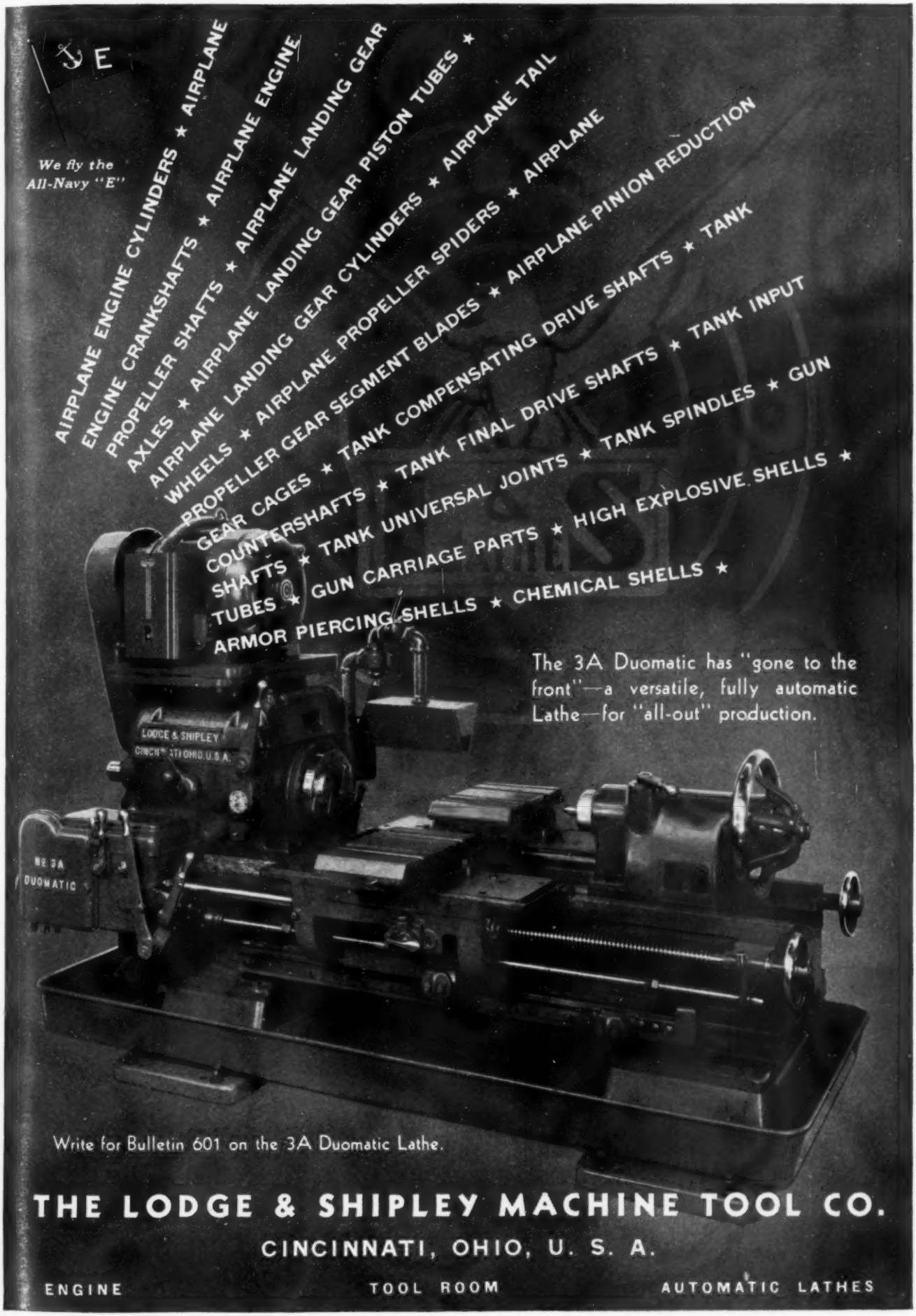
A Reeves Vari-Speed drive operates all the machines at variable speeds within approximately a 3 to 1 ratio. Except on the 53 and 72 in. units the machines are provided with a collector type of guard ring with a shut-off valve and down spout to carry the lapping compound into a small settling tank. These machines are adapted to a wide variety of single-surface parts.





We fly the All-Navy "E"

AIRPLANE ENGINE CYLINDERS ★ AIRPLANE ENGINE CRANKSHAFTS ★ AIRPLANE ENGINE PROPELLER SHAFTS ★ AIRPLANE LANDING GEAR AXLES ★ AIRPLANE LANDING GEAR PISTON TUBES ★ AIRPLANE LANDING GEAR CYLINDERS ★ AIRPLANE TAIL WHEELS ★ AIRPLANE PROPELLER SPIDERS ★ AIRPLANE PROPELLER GEAR SEGMENT BLADES ★ AIRPLANE PINION REDUCTION GEAR CAGES ★ TANK COMPENSATING DRIVE SHAFTS ★ TANK COUNTERSHAFTS ★ TANK FINAL DRIVE SHAFTS ★ TANK INPUT SHAFTS ★ TANK UNIVERSAL JOINTS ★ TANK SPINDLES ★ GUN TUBES ★ GUN CARRIAGE PARTS ★ HIGH EXPLOSIVE SHELLS ★ ARMOR PIERCING SHELLS ★ CHEMICAL SHELLS ★



The 3A Duomatic has "gone to the front"—a versatile, fully automatic Lathe—for "all-out" production.

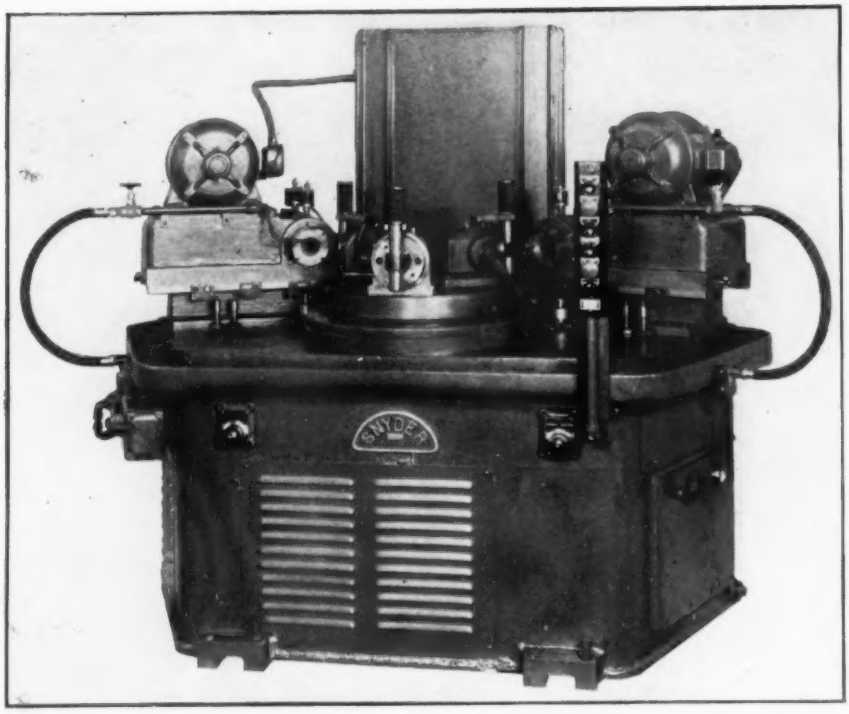
Write for Bulletin 601 on the 3A Duomatic Lathe.

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

ENGINE TOOL ROOM AUTOMATIC LATHES

Snyder Two-Spindle Hydraulic Valve Clearance Mill Is Made Especially for Milling Aircraft Pistons



A special two-spindle, hydraulic, valve clearance mill for aircraft pistons has been announced by Snyder Tool & Engineering Co., Detroit, Mich. The two milling spindles are mounted in tapered roller bearings and individually driven through V-belt drives. The quill type construction allows for an axial adjustment of 1 in. for cutter positioning and for tool wear.

Indexing is by means of a standard Snyder three-station Geneva index mechanism, an electrically powered, self-contained unit. A heavy index positioning pin enters the locating bushings automatically after indexing. The work cycle consists of an index followed automatically by the infeed of the cutters into the work. While one piston is being loaded the other two are receiving their successive cuts. The piston is positioned manually with a pin engaging with wristpin holes of the piston and is clamped by means of a cam action in the fixture.

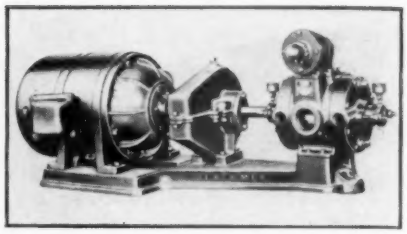
The mill has a welded steel base in which the hydraulic equipment is housed. Coolant is contained in a reservoir in the rear and the cover serves as a removable chip tray.

Perry Super-Kompak Turnstiles Have Pedal or Token Control

A portable turnstile called Super-Kompak, consisting of baseplate, guide railing and turnstile mounted together as a unit has been introduced by Perry Manufacturing Co., Inc., 101 Park Ave., New York, N. Y. The unit can be quickly and easily moved into place when needed for employee inspection. Removable chains close the gaps. It is available with foot pedal control for gate guard or in token controlled models. These turnstiles can be supplied for entrance and exit through the same machine or for one-way passage only. An automatic register for counting the employees passing in one or both directions is included in each unit.

Blackmer Steam-Jacketed Pump Handles Hot Greases, Oil, Tar

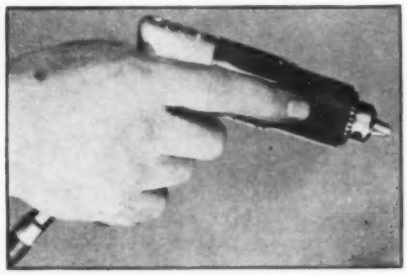
A simplified steam-jacketed pump for handling such materials as greases, tar, lard, palm oil and similar liquids, which must be processed or transferred while hot, has been introduced by Blackmer Pump Co., Grand Rapids, Mich. The sleeve bearings are grease lubricated and located outside the pump casing away from the pumpage. The steam-jacketed heads are made of cast semi-steel with threaded intake and exhaust steam ports and drain plugs. They are suitable for steam pressures up to 125 lb. For pressures in excess of 100 lb. per sq. in. the pump is furnished with anti-friction bearings. The stuffing box glands are of the bolted type with back-off nuts.



Standard units are available with the new steam-jacketed head in capacities from 20 to 700 gal. per min. and pressures up to 300 lb. per sq. in. They are furnished as single or multiple pump units with either single or double reduction gear drive.

Ingersoll-Rand 00A Drill Is Powered by Air Motor

A light weight pneumatic drill identified as the size 00A has been announced by Ingersoll-Rand Co., 11 Broadway, New York, N. Y. It is powered by a "Multi-Vane" air motor and lubricated by a built-in automatic oiler. A built-in speed regulator can be set for desired performance and



split-second throttle action provides quick and accurate hole starting.

The drill fits the hand conveniently with a pistol grip. A chuck shield gives protection and enables the operator to guide the drill more effectively.

Hercules Hot Stamping Outfit Made to Mark Crystal Holders

A No. 3 Hercules hot stamping outfit for marking crystal holders has been brought out by Acromark Corp., 7-13 Morrell St., Elizabeth, N. J. The machine consists of an arbor press operated by handwheel. A complete automatic stamping unit with an electronic cartridge heating unit and thermometer for control is assembled in the ram of the press. Automatically, a white or other color transfer tape

For greatest production from *Carbide Tools*

Rule 1

Select the correct grade of KENNAMETAL*

● In addition to the proper handling of carbide tools on boring, turning, and facing operations, it is necessary to choose the correct grade of KENNAMETAL for the specific job to get the greatest possible production.

Check the grade on the tool shank; this grade marking appears on all KENNAMETAL tools. If the tools are being made in your own plant, have the tool maker indicate tip grade on all shanks.

Using the wrong tool grade may mean unnecessary tip wear, a broken tool, or less than capacity production. To be sure the grade is correct for the job, consult your Vest Pocket Manual, or KENNAMETAL Catalog No. 43.

KENNAMETAL is made in four standard grades of hardness.

USE GRADE KM for the majority of jobs where a strong, durable tip is required, as in machining alloy steels and carbon steels above .35 carbon, of hardnesses up to 550 Brinell.

USE GRADES KH and K3H on scale-free, continuous cuts or where material being machined is very soft, as in SAE 1020, or free machining steels. On extremely hard steels (above 400 Brinell) it is advisable to use KH or K3H for resistance to edge wear.

USE GRADE K3H or K4H on precision boring or on continuous cuts where extreme wear resistance is necessary; use only K4H on non-ferrous metals, such as brass, bronze and light alloys.

Characteristics of the Four Grades of KENNAMETAL

Grade	Rockwell A	Rockwell C	Strength Transverse Rupture Lbs./Sq.In.	Thermal Conductivity cal./°C. cm./sec.
KM	90.8	77.6	305,000	.113
KH	91.3	78.6	275,000	.074
K3H	91.8	79.8	260,000	.068
K4H	92.5	80.6	225,000	.110

Write for your copies of the Vest Pocket Manual and the new McKenna Catalog No. 43.

* INVENTED AND MANUFACTURED IN U. S. A.

KENNAMETAL THE All American CARBIDE

McKENNA METALS Co.

103 LLOYD AVENUE, LATROBE, PENNA.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
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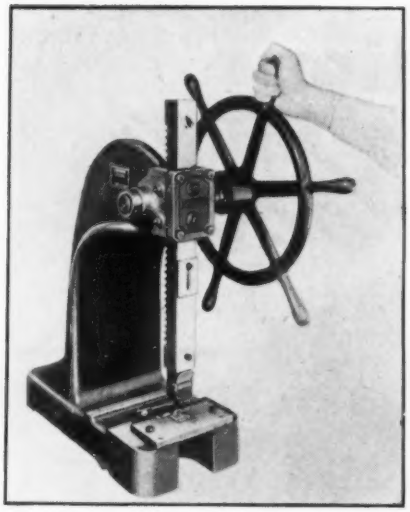


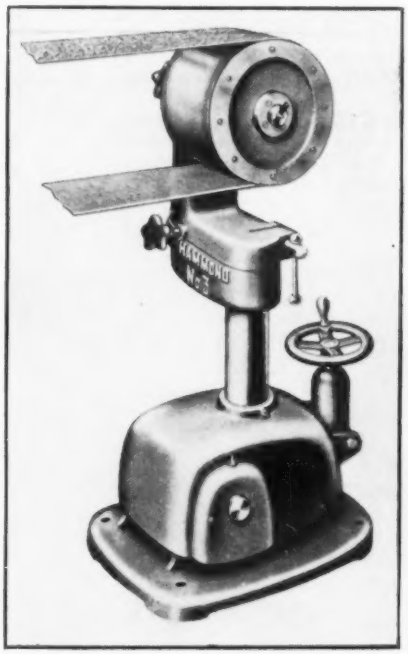
feeds under the marking type or dies at each stroke of the press, placing a mark in contrasting color on the holder.

This press outfit is also suitable for cold stamping of name plates and many other parts. This is accomplished by disconnecting the tape feed lever. An outstanding feature of the No. 3 outfit is the depth control plate on the front of the ram, enabling the operator to set the press for uniform marking.

Hammond Backstand Idler Used With Abrasive Belts

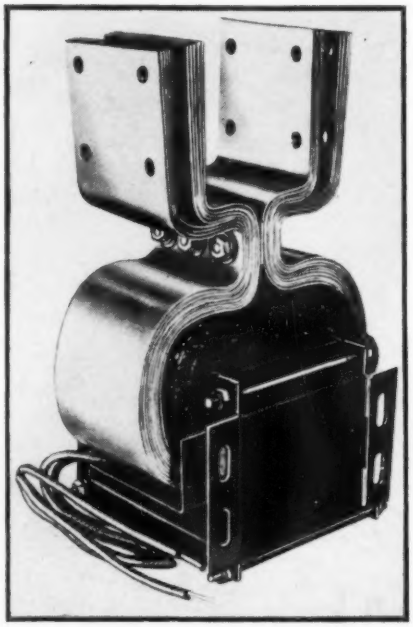
The No. 3 abrasive belt backstand idler for use with abrasive coated belts has been introduced by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich. It features a spring-loaded adjusting screw and handwheel to maintain uniform tension on the belts, and releases tension to make belt changes. This idler is a heavy-duty type with ball bearing idler pulleys with simple adjustment for belt positioning and tracking. The machine can be used in either the right- or left-hand position by turning the idler wheelhead and column 180 deg. and locking in position.

When employed with the Hammond OD cylindrical finishing machine, the No. 3 idler can be used on such parts as bombs, condenser tubing, shell cases, gun barrels, universal joints, steel tubing and brass magazines covering a range of sizes from ¼ to 9 in. outside diameter, straight or shouldered work.



Acme Welding Transformer Has Secondary Circuit Feature

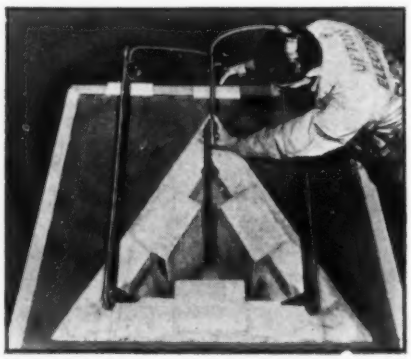
Development of a welding transformer for war production jobs has been announced by Acme Electric & Manufacturing Co., Cuba, N. Y., for operation on primary circuits of 115 volts, single phase, 60 cycle, and having secondary characteristics of 75 volt, 1,600 amp.



Upton Salt Bath Furnace Has Triangular Shaped Pot

A triangular type electric salt bath furnace has been announced by Upton Electric Furnace Div., 7450 Melville Ave., Detroit, Mich. The use of three electrodes, one for each phase of operation, is claimed to reduce the power costs and increase the efficiency of heating. The pot, which is triangular in shape, is bricked so that each electrode is placed in a deep recess in the bricking. Two steel pots, one inside the other, and both insulated from each other and from the outside shell, reduce heat losses.

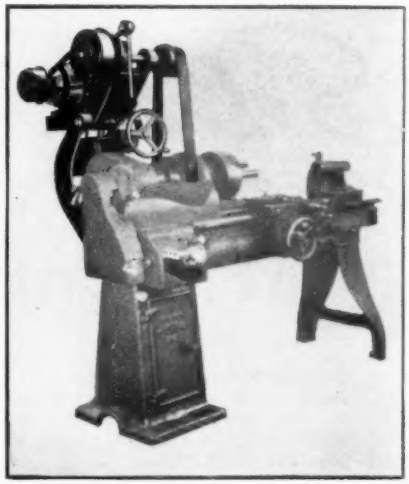
Electrodes of ordinary steel are fastened to the water cooled bus bars by a single-bolt connection. Water cooling the bus bars permits handling them with bare hands.



Powermatic Variable Lathe Drive Has Standard Mounting Bracket

A Powermatic lathe drive utilizing a standard mounting bracket has been introduced by Powermatic Machine Co., 659 South Anderson St., Los Angeles, Calif. The speed of this drive may be instantly changed, either while the machine is operating or before starting operations. One speed control enables the operator to select the desired cutting speed for any material. Belt tension remains at the proper value regardless of the load or speed setting.

The mounting bracket can be attached to any machine by four bolts.



A floor base model is also available especially adapted for shaper, drill press and other machines where this type is more convenient.

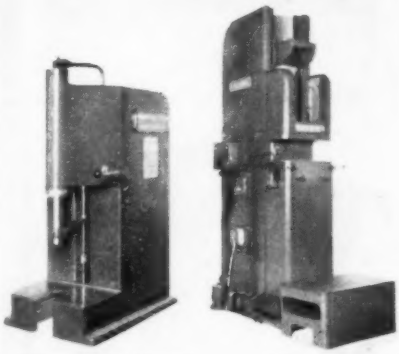
HydroLectric Motorized Trucks Are Equipped With Four Wheels

A HydroLectric truck designed to handle loads of 4,000 lb. has been announced by Lift Trucks, Inc., 2425 Spring Grove Ave., Cincinnati, Ohio. Two-button control on the handle, one for forward motion and the other for reverse, operate in conjunction with the controller unit. Front or side lift is accomplished by the horizontal hydraulic ram. The load holds at any point on the arc of the handle. Rear load wheel drive insures positive traction.

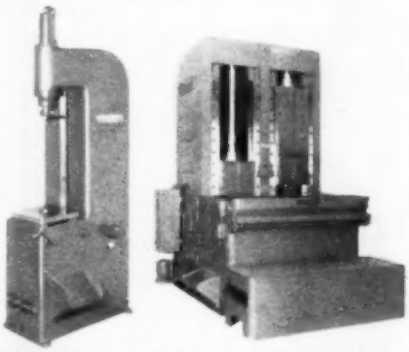
The frame is all-steel construction

You CAN pick the wrong Machine

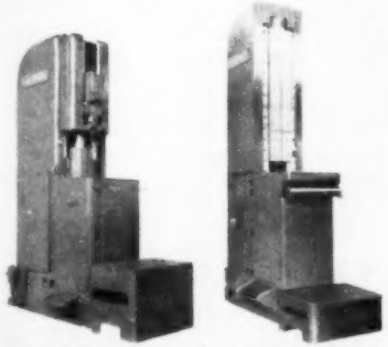
UNIVERSAL HORIZONTAL



"JUNIOR" PRESS PULL-UP



"SENIOR" PRESS DUAL RAM



PULL-DOWN SINGLE RAM

These standard Colonials come in scores of models

How to get more production with your Broaches------

3. BY PICKING THE RIGHT MACHINE FOR THE JOB

THE very flexibility of broaching machines—the variety of jobs to which each standard "Colonial" can be applied — frequently makes it difficult for the user to select the proper type of broaching machine for a specific operation or group of operations.

Proper machine selection depends primarily on three factors:

1. The nature of the job.
2. The capacity required.
3. The length of stroke needed.

Following are some hints as to selection of the best machine type for different kinds of jobs:

ROUND HOLE BROACHING: Can be handled on practically every type of standard broaching machine except those specifically designed for surface broaching. If parts are extremely large, or floor space is at a premium, a vertical machine is preferable to a horizontal type. If the operation is mainly a "sizing" job, or if the broach is not too large, a "Senior Press" may be used.

If permissible for parts to drop off the broach at the end of the stroke, and not too large to handle properly, a "Pull-up" may be used.

If the parts are too large, or if the part requires accurate locating in a fixture, a "pull-down" may be preferable.

SURFACE BROACHING: In high production, the most suitable machines are Colonial Single and Dual Ram vertical machines. If maximum production capacity is not required, a "Senior Press" may be used on light jobs. Lower production surface broaching operations may also be performed on a "Universal Horizontal" if already available. If automatic indexing is desired, a "Senior Press" or a ram type of machine should be used.

KEYWAYS: While keyways may be broached on vertical machines, it is usually best to use a "Universal Horizontal" for this work in combination with a key-way horn. This type of machine provides greater ease of loading for such work.

HELICAL SPLINES: Best performed on a "Universal Horizontal" in combination with a helical lead bar, providing maximum accuracy and ease of handling. Can also be performed on vertical machines, of course.

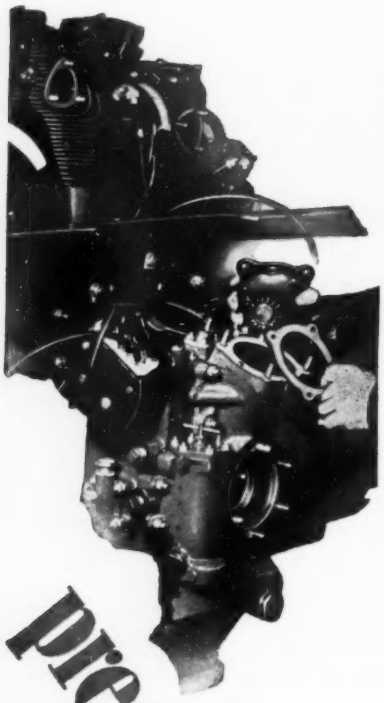
The above, of course, is not a complete summary and individual recommendations may differ depending on the nature of the job. As to machine capacity and length of stroke, it is always advisable to obtain the recommendation of your broaching machine and broach producer. Here the best guide is still "experience"—the knowledge acquired from tooling and studying thousands of broaching operations.

colonial BROACH COMPANY

Broaching Machines *Broaches-Broaching Equipment*

DETROIT . . . . . U. S. A.

HOBBING HELPS



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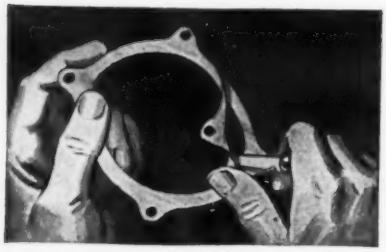
In close-precision aircraft adjustments . . . *quick* accuracy is insured by Laminum shims. From factory assembly to vital field servicing! Laminum shims (easily peeled precision brass laminations) are cut to your specifications.

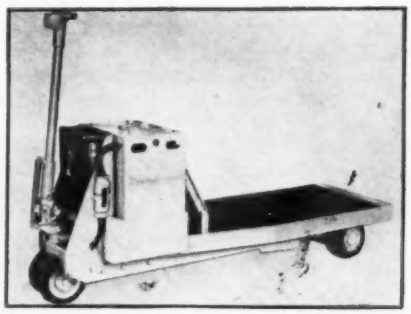
Stock shim materials obtainable from mill supply dealers. (Write us for shim application folder and Laminum sample.)

Laminated Shim Company, Inc.
50 Union St., Glenbrook, Conn.



it's
LAMINUM
THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

1813



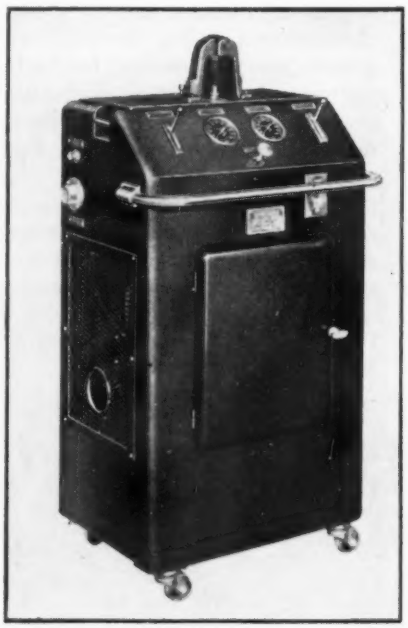
and heavily reinforced. The truck has four wheels, to give greater stability; these are furnished in rubber or other protective tread as desired. The inclosed motor and controller provide a safety factor. This truck is furnished in width of 26¾ in. and two standard heights of 9 and 11 in.

Ithaca Toolmaker's Compass Scribes, Draws Small Circles

Designed for metal workers and draftsmen to meet the need for scribing and drawing small circles a few thousandths to ⅝ in. radius, Ithaca Scientific Instrument Co., Ithaca, N. Y., has brought out a toolmaker's compass. To set the radius a worm clamp nut is loosened and after the setting this nut is tightened to lock the worm gear. Another nut is provided to lock the scribing needle and pencil adapter at the desired length.

Denison Announces Tester For Aircraft Spark Plugs

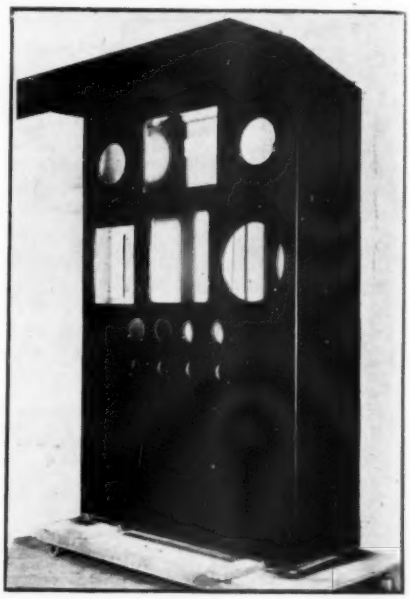
A spark plug tester for use in testing the firing precision of aircraft spark plugs has been announced by Denison Engineering Co., Columbus, Ohio. Air pressure up to 750 lb. per sq.in. can be developed in a few seconds. The action of the cylinder clamps the plug into an air-tight chamber. The desired voltage and pressure are selected and the action of the plug recorded.



The stand consists of a welded steel frame which is mounted on swivel casters and equipped with start-stop pushbuttons, low pressure needle valve, high and low pressure air gages, adapters, low voltage terminal, operating levers and high voltage connector.

Hays Now Makes Control Panels Of Masonite to Replace Steel

To take the place of steel in instrument and control panels the Hays Corp., Michigan City, Ind., has brought out



panels made of Masonite reinforced with steel angles. The body of the panel is made of cross-grained Masonite ⅝ in. thick bolted to a framework of angle steel. Braces of steel reinforce the center of the panel for support. The canopy and doors are made of the same material as the body of the panel. The outside finish is black lacquer and the inside is finished with two coats of gray lacquer.

Fend Skin Cream or Lotion Protects Against Dermatitis

Announcement has been made by Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa., of Fend industrial skin cream or lotion as a protection against dermatitis. It is non-clogging to the pores and non-toxic. Soap and water will quickly remove the lotion.

Evercrete Liquid for Masonry Waterproofs and Dustproofs

A transparent penetrating liquid for use on any type of masonry has been introduced by Evercrete Corp., 19 West 44 St., New York, N. Y. This material is claimed to permanently dust-

The RIGIDHOBBER for precision hobbed GEARS AND SPLINES

THIS rigidly built hobbing machine is designed to generate precision hobbed gears and splines either in quantity or small lots.

RIGIDITY OF WORK HEAD AND HOB

The work head is supported both below and above insuring rigidity to work during cutting operation. The hob, on all but very small gears, is supported at the drive end of the hob arbor and by an outboard support.

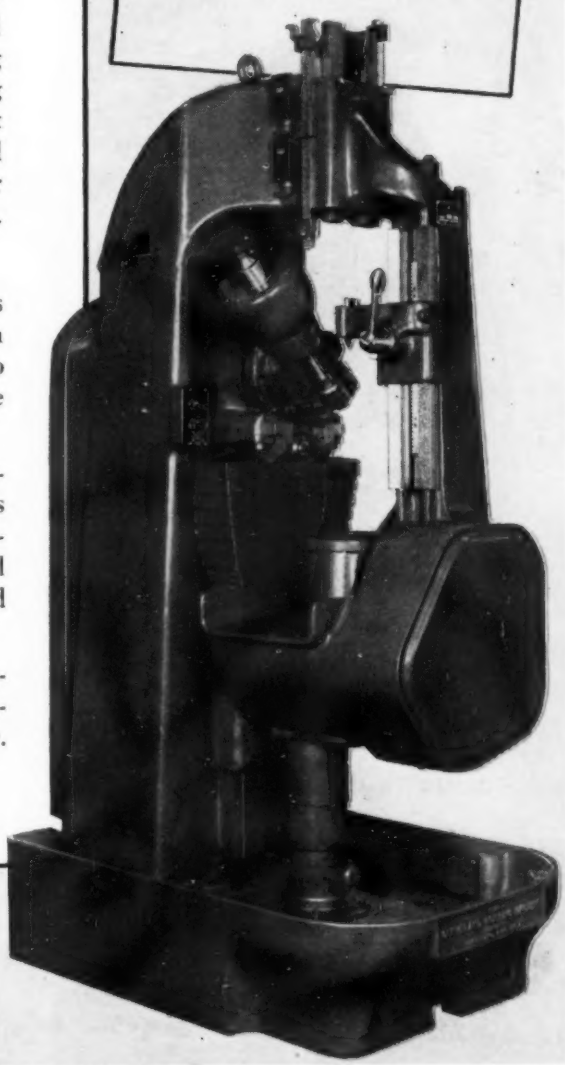
PRECISION WORK

The utmost in precision is assured—on small lots and on quantity production—due to the rigid support given both the hob and the work.

We also furnish the Rigidhobber in 8 spindle rotary models for high production of duplicate work. 8 pieces are finished simultaneously—a finished piece at every cycle.

We can make favorable deliveries on both models when accompanied with high priority order.

Bring your hobbing problems to CH engineers for specific information on your job or send sample or blueprint for estimate.



HOBBING HELPS FOR BOOSTING WAR PRODUCTION

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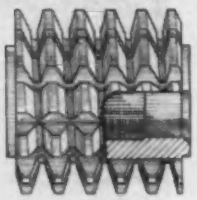
HOB FORMS



Here is a Gear Hob—a cutting tool threaded, gashed and backed off to give cutting clearances, hardened and then ground.

Hobs for producing gears of the interchangeable involute system are based upon a theoretical straight-sided rack. The teeth of the hob are inclined at an angle equal to the pressure angle of the gear and usually the root and tips are modified to eliminate top and bottom interference.

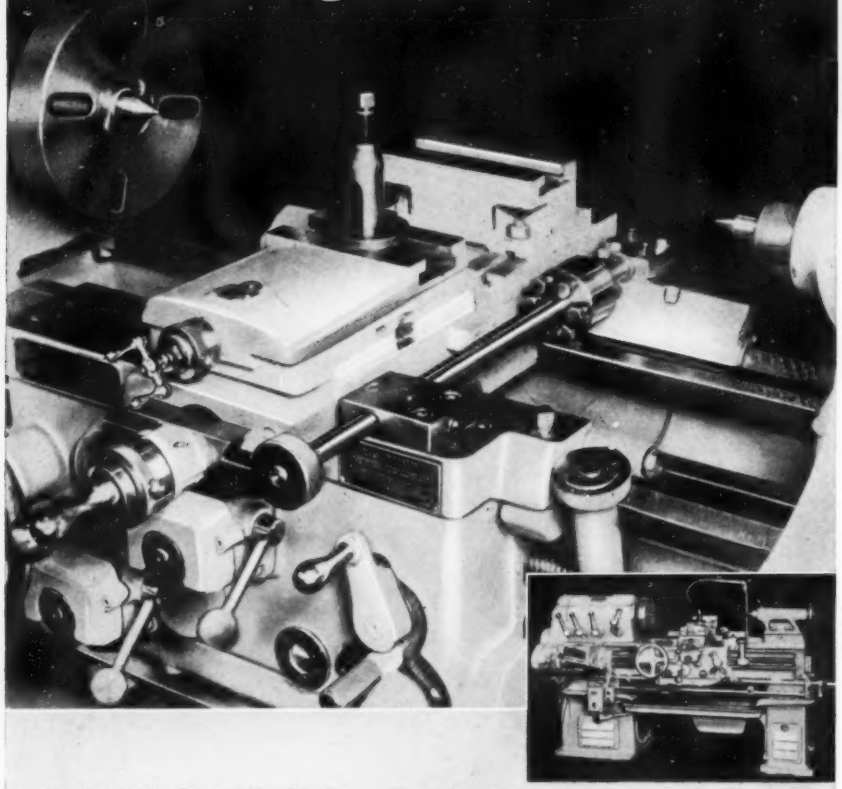
Gear hobs based upon a basic rack will cut any number of teeth. This eliminates the need of a special tool for each gear if the gears vary in diameter. When high helix angles are to be cut the hob teeth are usually modified, eliminating the first two or three rows and gradually tapering the hob.

Hobs may have any number of starts or leads depending upon the operation to be performed. For extreme accuracy—only a single lead should be used—for roughing operations, double or triple leads may be used—for special jobs, multiple start hobs with as many as five or six leads are often used.

This bulletin explains the Rigidhobber in detail—gives specific information on construction and operation—tells the sizes and capacities now furnished.

The CLEVELAND HOBBING Cleveland ... MACHINE Company ... Ohio

equipped for VERSATILITY



"REED-PRENTICE" Geared Head Lathe . . . Bijur-Lubricated

● Improved machine versatility is demanded . . . greater capacity . . . closer accuracy . . . faster speeds. Modern machines must be adequately protected. More and more they rely upon correct, automatic lubrication—BIJUR "built-in" equipment.

BIJUR LUBRICATING CORPORATION • LONG ISLAND CITY, N. Y.

BIJUR

AUTOMATIC *Metered* LUBRICATION

1616

proof and make concrete waterproof and crumbleproof. It is easily applied and penetrates immediately. It serves as a binder for surfaces that are to be painted because moisture is prevented from entering. It is said to be odorless and impervious to acids. Evercrete is available in containers of 1, 2, 5, 30 and 55 gal.

Johnson Wax-Fortified Paint Resists Marring and Scratches

A wax-fortified paint has been introduced by S. C. Johnson & Son, Inc., Industrial Maintenance Div., Racine, Wis., which is water repellent and resists marring and scratching. It may be applied over any exterior type primer, and is made for spray gun application as well as for brushing over the surface. The paint is available in flat or enamel finish and in eleven colors, black and white.

Adhere Spraymask for Plastics Serves As Protective Coating

A waterproof protective and abrasion-resistant mask for plastics called Spraymask has been announced by Adhere, Inc., 1220 Maple Ave., Los Angeles, Calif. The mask is applied with a paint spray gun, dries clear and transparent, and will peel off in a sheet. Aircraft companies have found it particularly adaptable for spraying formed plastic glass parts such as bomber noses and gun turrets. Among other uses the mask serves as a protective coating against paint, grease and abrasion. It is said to be impervious to paint thinners and ordinary solvents.

TRADE PUBLICATIONS

ARBITRATION The American Arbitration Association, 9 Rockefeller Plaza, New York, N. Y., announces a revised edition of its Voluntary Labor Arbitration Rules of Procedure, to meet war regulations and conditions. The rules are accompanied by a manual for using them.

BULLETIN CABINET Full details of the modern bulletin display cabinet known as M.S.A. Tell-Board are contained in descriptive bulletin CD-10 issued by Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa.

DIAMOND WHEELS J. K. Smit & Sons, Inc., 157 Chambers St., New York, N. Y., has prepared a 12-page illustrated booklet entitled "Secomet Diamond Wheels—How to Use Them . . . ," containing important hints and tips on the proper use of these special tools.

DRIVES The 36-page "American Econ-O-Matic Drives Catalog," issued by American Pulley Co., 4200 Wissa-

nickon Ave., Philadelphia, Pa., deals with both V-belt and flat-belt drives and includes data on motor base mountings for special applications. Blueprints, drive selection tables and dimension tables make it especially handy for reference and comparison.

DURONZE The 80-page revised Duronze manual, published by the Bridgeport Brass Co., Bridgeport, Conn., contains technical data and applications for five different Duronze alloys supplied in sheet, rod, wire, tubing and ingot.

FIXTURES Zagar Tool, Inc., 23880 Lakeland Blvd., Cleveland, Ohio, offers an 8-page bulletin illustrating and describing index and holding fixtures.

GRINDING "What's Your Grinding Problem?" is the title of the 27-page trouble-shooting manual for grinding machine operators published by the Norton Co., Worcester, Mass.

GRINDING The Sterling Grinding Wheel Div. of the Cleveland Quarries Co., Tiffin, Ohio, has issued a series of folders designed to instruct "green" as well as experienced workmen in proper grinding.

HONING Bulletin No. 149, issued by Barnes Drill Co., 814-830 Chestnut St., Rockford, Ill., describes features, advantages and specifications of the Barnesdril No. 4014 quick change speed self-oiling hydraulic honing machine.

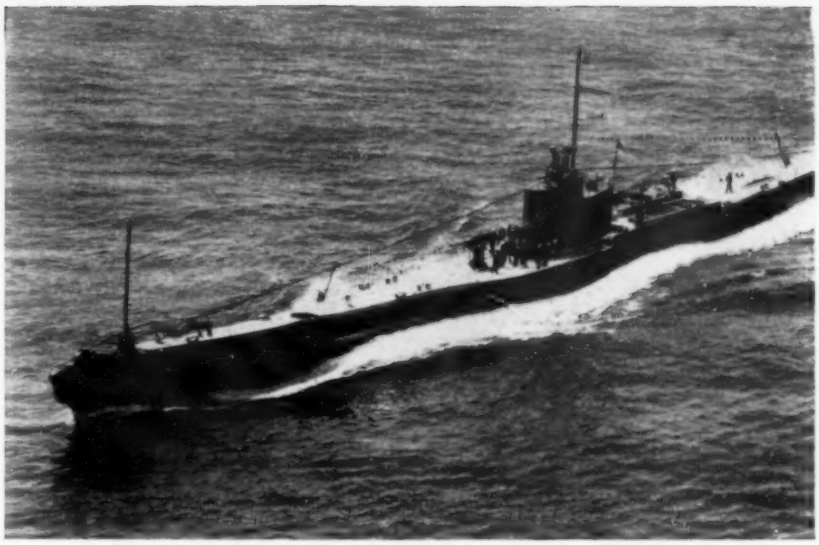
LIGHTING "Flashes 1042," a 20-page brochure released by The Fostoria Pressed Steel Corp., Fostoria, Ohio, illustrates and describes how good lighting and the near infra-red process are speeding the production of war materials used on the land, on the sea and in the air.

LUBRICATION "The Graphite Lubrication Handbook," prepared by Nassau Laboratories, Hackensack, N. J., explains the work which graphite performs and lists the various products supplied. The indexed list of applications will aid the engineer in keeping machines at peak performance.

MILITARY SERVICE Booklet R-1032A, prepared by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., provides information about Westinghouse jobs and gives the answers to many questions arising in the minds of workers changing from civilian to military life.

WELDING Four-page bulletin 101, describing the new line of "Revers-O-Charge" welding equipment designed for welding of aluminum alloys, is available from Progressive Welder Company, 3001 East Outer Drive, Detroit, Mich.

WELDING A colorful, well illustrated, 4-page bulletin, No. 205, has been issued by the Industrial Div., Ransome Machinery Co., Dunellen, N. J., on their 20-ton capacity welding positioner.



Sub Propeller Shafts Needed Quickly!

Story of How Ryerson Ingenuity Saved Five Weeks

URGENTLY needed at a distant shipyard were fourteen forged submarine propeller shafts that must pass Navy specifications.

Forgings were specified, but none could be secured in time.

Quickly available in Ryerson stocks were cold rolled bars — the right size — but in five different analyses.

Navy Inspectors were skeptical. Could Ryerson heat-treat and assure uniform physicals—also furnish pull tests for each bar? Well, no; because the piece left after the bars were cut to the needed length, would be too short to make a standard 6″ test sample. A delay of five weeks loomed ahead. . . .

Then Ryerson metallurgists found a way: Inquiry revealed that the shafts were to be machined down at each end for a distance of 7″. So, why not cut a piece from the side of each bar, *before machining*—enough for all tests yet leaving sufficient stock for machining to size? The idea worked perfectly.

The data charts always furnished with Ryerson Certified Steels provided the exact analysis of each bar and assured proper heat-treatment. A few minutes hacksaw work yielded the necessary test samples . . . and all fourteen bars passed the rigid Navy Inspection with flying colors.

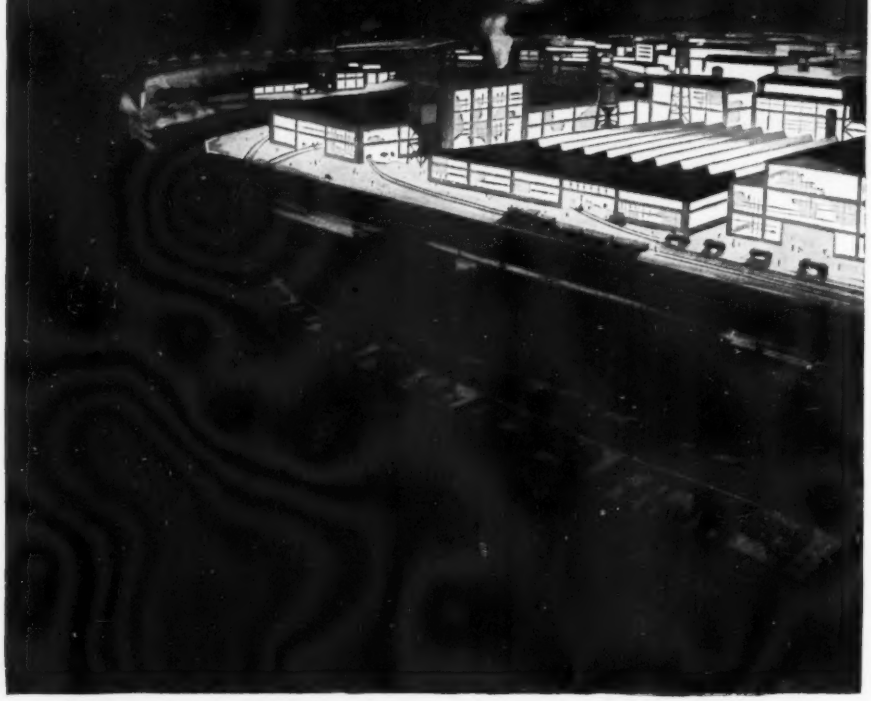
Ryerson ingenuity has helped many manufacturers in solving production problems—has also cut ultimate delivery time from months to days. Ryerson engineers and metallurgists, backed by a century of service to the nation, are ready to work with you in accordance with WPB plan in making the most of all available steel.

Cutting 6″ test pieces from side of bar without affecting length.

JOSEPH T. RYERSON & SON, INC.
CHICAGO · MILWAUKEE · ST. LOUIS · DETROIT
CLEVELAND · CINCINNATI · BUFFALO · BOSTON
PHILADELPHIA · JERSEY CITY

RYERSON STEEL-SERVICE

. . . In 24-Hour Service on Hundreds of Production Fronts



All during America's conversion to wartime production, Standard Conveyor engineers were hard at work in foundries, munitions plants, steel and brass mills, aviation machine shops and scores of other plants . . . helping production executives to plan and install conveying equipment. For production men knew that experienced Standard engineers could quickly interpret their requirements . . . specify, or if need be—design the best types of power and gravity conveyors for handling particular types of commodities.

And just as Standard engineers rose to the needs of today's all-out war effort, they will respond with equal skill to the changing requirements of the future.

If you are producing war material or other products regarded as necessary to the war effort, Standard Conveyors are available for your handling needs. Write Dept. AM-1 for full information.

STANDARD CONVEYOR COMPANY
General Offices: NORTH ST. PAUL, MINN.

★ ENGINEERED FOR FASTER PRODUCTION ★

NEW BOOKS

OXYACETYLENE WELDING AND CUTTING—*By J. W. Giachino, formerly professor of industrial education, Western Michigan College of Education, and now lieutenant, senior grade, U. S. Navy.* 196 *pages. Published by the Manual Arts Press, Peoria, Ill.* $2.50.

Written especially for the student welder and containing the details of oxyacetylene welding and cutting procedure that he must understand, this book also includes much information that will be helpful to the veteran welder. In addition to giving step-by-step instructions for making standard joints, the book contains discussions of official regulations for the prevention of fires, and for installing and operating gas systems for welding and cutting.

Also included are the official army tests for welders and the practice welds that go with them, and a detailed treatment of special pipe joints. Each of the 26 lesson units is illustrated with line drawings and photographs which can be understood easily by the beginner. Each unit covers the proper method of handling equipment and using the torch, and includes photographs showing actual welds made under production conditions. Considerable information is included on the welding of aluminum alloys and stainless steel.

•

SHIPBUILDING BLUEPRINT READING—*By John L. Tomlinson, instructor in apprentice school, Cramp Shipbuilding Company, and assistant to principal, Benjamin Franklin High School, Philadelphia.* 208 *pages. Published by the American Technical Society, Chicago, Ill.* $3.00 *with answers,* $2.75 *without answers.*

This book approaches the teaching of blueprint reading for shipbuilding trades in a manner designed to convey the greatest possible mastery of the subject in the shortest possible time, to meet the present needs for expansion in the shipbuilding industry. The author believes that the skills, knowledge and techniques needed to make ship drawing are not necessary in order that a student may learn to read and interpret that drawing, or the blueprint which has been made from it. With this in mind, the author presents a straightforward explanation which concerns itself chiefly with developing the necessary skill in visualization, together with a thorough understanding of the symbols and abbreviations which commonly appear on ship prints.

The preliminary sections have been arranged to teach all the basic information necessary to read a ship print. They cover simple arithmetic, a glossary and a dictionary of abbreviations of ship terms, method of projection

and relation of views, line and scale symbols, and methods of developing shapes of surfaces. Following each section of the preliminary explanation, there are test sheets which give the student opportunity to try out the knowledge he has acquired. Later sections of the book give a general discussion based on typical drawings, wherein the use of all the symbols, abbreviations, projections, etc., is explained in detail to supplement the knowledge the student has gained from the preliminary section. Finally, a group of typical ship drawings, together with question sheets, give the student practical training in shipbuilding blueprint reading. The book is well illustrated with blueprints and black and white prints, and is wirebound so as to lay flat on the student's desk when opened.

SEEN and HEARD

By JOHN GODFREY

White Paint and Machine Tools

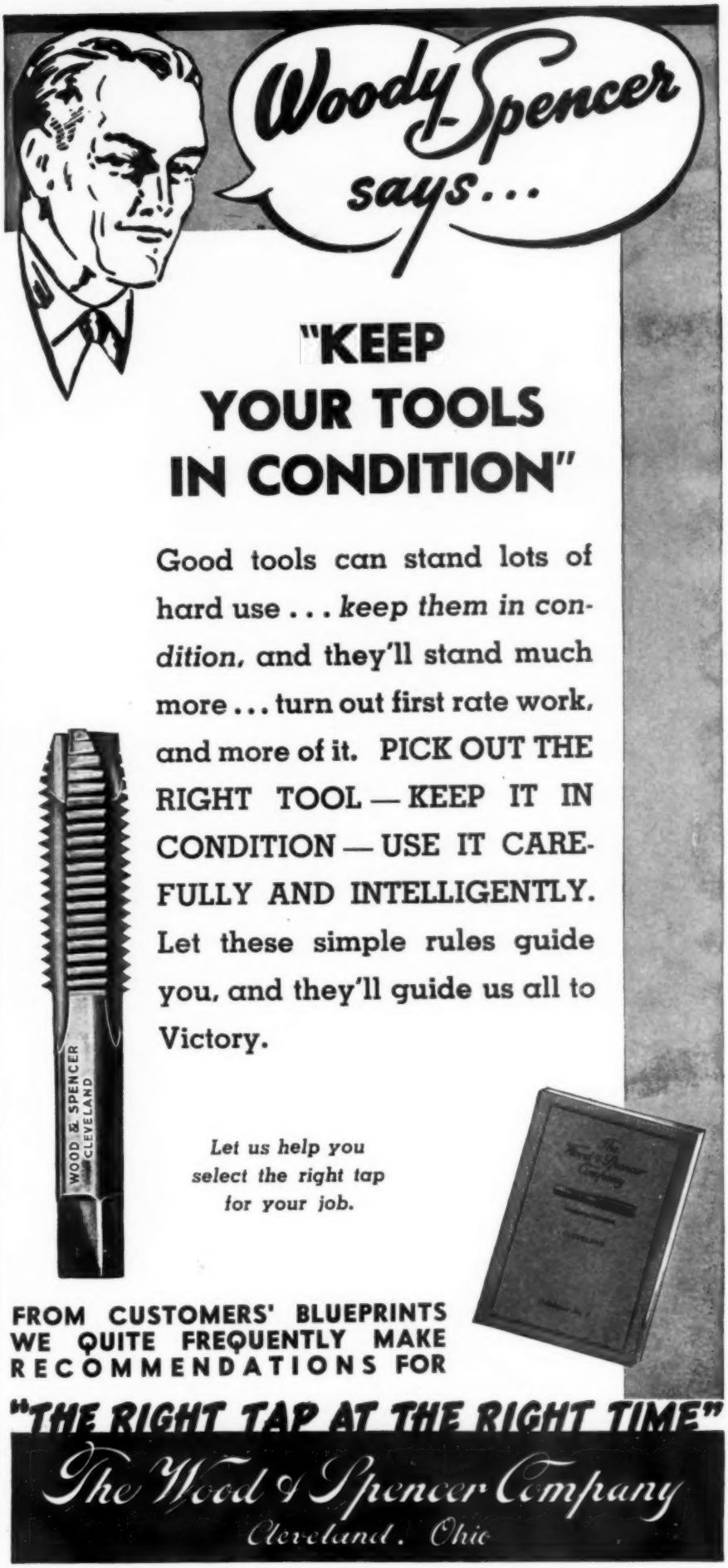
The illustration (*AM*—Vol. 86, page 1353) brings to mind numerous previous experiments in using light colors in painting machinery. In our shop a staid green was the standard color and the machines got a new coat as a Christmas present every year. But way back in the early 90's Daniel Wightman, general manager of the Pittsburgh Locomotive Works, painted every machine tool in the place with a glossy white paint. This was particularly startling in Pittsburgh, which was even more smoky then than now. Dan was much pleased with the experiment and felt sure that he got more and better work as a result of this innovation.

The next experiment of this kind that I recall was in the shop of the Bullock Electric Company in Norwood, suburb of Cincinnati, Ohio. Here every machine had a coat of aluminum paint plus a motor all its own. It was the first shop I know of with all unit drive. Of course it was a publicity stunt at the time as Bullock built motors. The company was taken over by Allis-Chalmers.

John Hill was impressed with the white enamel in the Pittsburgh Locomotive shop and, as many will recall, used white on all the presses, folders, binders and other machines in his print shop in New York. A coat of white isn't new but it has a number of good points!

Welding and Cementing Metals

Two developments which have recently been made public promise revolutionary changes in airplane construction. One is the Heliarc method of


Woody Spencer says...
"KEEP YOUR TOOLS IN CONDITION"
Good tools can stand lots of hard use . . . keep them in condition, and they'll stand much more . . . turn out first rate work, and more of it. PICK OUT THE RIGHT TOOL — KEEP IT IN CONDITION — USE IT CAREFULLY AND INTELLIGENTLY. Let these simple rules guide you, and they'll guide us all to Victory.
WOOD & SPENCER CLEVELAND
Let us help you select the right tap for your job.
FROM CUSTOMERS' BLUEPRINTS WE QUITE FREQUENTLY MAKE RECOMMENDATIONS FOR
"THE RIGHT TAP AT THE RIGHT TIME"
The Wood & Spencer Company
Cleveland, Ohio

W-S Standard Reamers with carbide tips. Tapered shank (illustrated) and straight shank types. Sizes: ¼ to 1½.

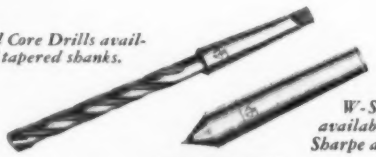
STANDARD REAMERS
available from stock

REAMERS and many other cutting tools formerly in the "special" class are now STANDARD with us. The majority of these STANDARD cutters is in stock *most of the time.* Our broad line often enables the consolidation of tool orders and saving of valuable time. Each W-S tool is genuine CARBOLOY tipped. The grade used is the one best suited to do a cutting job on the metals for which the tool was ordered. (Other brands of carbide can be specified.)

Carbide tipped tools are not just a specialty with us . . . we make them *exclusively.* You can *expect* and *get* uniform, high quality results with W-S tools. Write for new FREE Catalog 942 and latest prices. WENDT-SONIS COMPANY, HANNIBAL, MISSOURI.

SAVE TIME . . . wire or phone your requirements!

W-S Carbide Tipped Core Drills available in straight and tapered shanks. Sizes: ½ to 1½.



W-S Carbide Tipped Centers available in Morse, Browne & Sharpe and Jarno Tapers.

WENDT W-S SONIS

CARBOLOY CUTTING TOOLS

CENTERS ★ DRILLS ★ CORE DRILLS ★ COUNTERBORES ★ SPOT FACERS
END MILLS ★ REAMERS ★ HOLLOW MILLS ★ LATHE BITS ★ SPECIAL TOOLS

welding magnesium which is the outcome of over ten years' experimentation at the Northrup aircraft plant. This uses a tungsten electrode to draw the arc which is surrounded by an envelope of helium gas which prevents air reaching the weld and makes a flux unnecessary. We seem likely to use magnesium much more extensively than in the past for two reasons. To relieve some of the demand for duralumin and to give stiffer sheets for the same weight.

The other is known as the Clyde-Weld process of joining metals, metal to wood, metal to rubber, metal to plastic with a bond that is much stronger than riveting or bolting. A special thermosetting cement of a thickness varying from 0.002 to 0.006 in., used with proper heat and pressure, makes an unbelievably strong joint. While designed primarily for use on automobile bodies it is being tried in airplane construction, so far with excellent results. This method makes possible the joining of sheets with a perfectly smooth surface and is believed to have possibilities of adding appreciably to plane speed by eliminating the "ding" due to rivet heads and other slight irregularities on the surfaces of the plane.

Rolling Shapes Without Scratches

Makers of machines to roll shaped sections such as channels, Z's and S's have had little trouble as long as they were handling steel where a few small scratches didn't matter much. But in rolling dural or alclad the scratch is an entirely different matter. With alclad a slight scratch gets through the aluminum coating to the dural and the usefulness for the outer coating is destroyed.

This means that rolls have to be designed to form the strip to the desired cross-section, but that there can be no slipping between roll and the surface of the strip. When you start to roll a flat strip into some other shape parts of the rolls have different diameters. This means varying speeds at different parts of the forming surface, which is what makes scratches and abrasions. Planning rolls that will avoid this is a real problem for tool designers.

Welding Plays Top Role in A.A. Gun Recoils—Correction

In the recently published article entitled "Welding Plays Top Role in A.A. Gun Recoils" (*AM*—Vol. 86, page 1371), the caption under the photograph at the top of page 1381 should have read: "Welded elevating gear sectors for recoil mechanisms are roughed in Newark gear cutters and then finish hobbed in No. 5 Newark machines equipped with special table fixtures."

VICKERS HYDROMOTIVE CONTROLS PROMOTE SAFETY

CONSTANT DELIVERY PUMPS

CONTROL ASSEMBLIES

Representative of More Than 5,000 Standardized Vickers Units for Every Hydraulic Power and Control Function

FLUID MOTORS

VARIABLE DELIVERY PUMPS

DIRECTIONAL CONTROLS

PRESSURE CONTROLS

VOLUME CONTROLS

Accident rates increase in times like these when unskilled workers must be hired to operate production machines. Machines equipped with Vickers Hydromotive Controls help to keep down accident rates.

Vickers Hydromotive Controls are simple, easily mastered and offer less opportunity for accident-producing mistakes. Completely automatic cycles are easily set up. Overload protection is positive and automatic. Controls may be so interlocked that incorrect operation sequence is impossible. Vickers Controls can be operated with one finger and can be placed wherever most convenient for the operator. As a result, the operator is not subjected to nervous or muscular strain.

All of these factors tend to reduce accident rates, increase production, reduce work spoilage, eliminate damage to machines. Vickers Application Engineers will gladly consult with you on specific machine requirements.

VICKERS *Incorporated*

1410 OAKMAN BLVD., DETROIT, MICHIGAN

FOR OUR ARMED FORCES

INDUSTRIAL AMERICA HAS PLEDGED

ALL-OUT AND EVER-INCREASING PRODUCTION

FOR OUR ARMED FORCES

—THAT THEY MAY QUICKEN THE DAY OF VICTORY

—THAT THEY MAY RETURN IN SAFETY

—AND THAT THE WORLD MAY BE ASSURED

OF A LASTING PEACE

TRATEGIC

As a Direct Hit on An Aircraft Carrier

We have fixed our sights. Our entire set-up is revolutionized. Now we concentrate on Mounted Wheels and Vitrified Grinding Wheels 3" and under in diameter—24 hours a day, every day.

Our central location makes speedy deliveries certain.

- Wheels flow off our production lines and into your plant in a swift, steady stream. Speed assured on all orders. Count on us to meet bottleneck emergencies.
- Valuable man hours saved in your plant. There is no waiting for wheels.
- Customers—new wartime and old—get the same high quality that has been maintained since we introduced the first Mounted Wheels 45 years ago. We can take care of all your requirements for wheels 3" and under.

• • •

You should have our new catalog which illustrates in actual colors and sizes the largest line of Mounted Wheels made. Send for copy today.

AMERICA'S HEADQUARTERS FOR MOUNTED WHEELS

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WHEEL & MFG. CO.
1101 W. Monroe St., Dept. AT, Chicago, Ill.

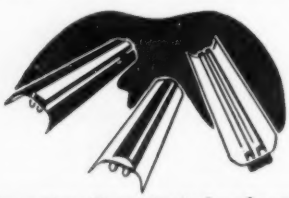
A LIGHTING FIXTURE HAS A BIG RESPONSIBILITY IN A WAR PLANT

Here are the Answers..

to questions that contractors, wholesalers, engineers, chief electricians, maintenance and purchasing departments are asking about Fluorescent Lighting fixtures

1. How can I be sure of getting dependable lighting fixtures?

By specifying fixtures that have been tested and certified for electrical, mechanical and lighting efficiency by independent experts. Certified FLEUR-O-LIER fixtures meet 50 definite standards set up by MAZDA lamp manufacturers to assure dependable performance. They are tested and *Certified* to those standards by Electrical Testing Laboratories, Inc., of New York.

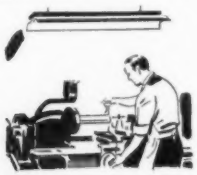


2. Who makes these tested and certified fixtures?

Certified FLEUR-O-LIERS are made by over 40 leading fixture manufacturers. Any fixture manufacturer who complies with the FLEUR-O-LIER requirements may participate in the program.

3. What are some of the points checked by this testing?

Some of the most important specifications checked by Electrical Testing Laboratories are: High power factor, flicker correction, certified ballasts and starters, brightness control, safety, maximum light output, correct heat dissipation and many others.



4. Don't other makes of fixtures have these features?

Perhaps. But you can be sure of them *all* in Certified FLEUR-O-LIERS. And because they are Certified by E.T.L., any further test or check by the user is unnecessary.

5. Do FLEUR-O-LIER fixtures have non-metallic reflectors?

Many FLEUR-O-LIER Manufacturers now make Certified fixtures using non-metallic reflectors, conforming to WPB order L-78 (Amended) and U.S. Bureau of Standards Specifications. FLEUR-O-LIER specifications also cover these units.

6. How can I tell FLEUR-O-LIERS from other fixtures?

FLEUR-O-LIERS are easily recognizable by the Certification label shown on every fixture. Make sure this label is on the fixtures you specify to assure dependable lighting performance and operation.

7. Are FLEUR-O-LIERS now available—and on what basis?

They are now available on a suitable priority to war plants. Ask your supplier or, for a complete list of manufacturers, write FLEUR-O-LIER Manufacturers, 2133-1 Keith Building, Cleveland, Ohio.

NEW! Booklet giving complete FLEUR-O-LIER manufacturing specifications. All technical information for architects, contractors, wholesalers, engineers and purchasing departments on electrical, mechanical and lighting standards as set up for CERTIFIED FLEUR-O-LIER fixtures. Write NOW to FLEUR-O-LIER Manufacturers, 2133-1 Keith Building, Cleveland, Ohio.

FLEUR-O-LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

How Gulf Lubrication Service Engineers are helping war industry increase production!

75 mm. gun tubes . . . by following the recommendations of a Gulf Industrial Lubrication Service Engineer, a manufacturer of 75 mm. gun tubes increased production 10%, increased tool life up to 30%, reduced fire hazard, and reduced the amount of cutting oil necessary for make-up.

* * * *

105 mm. gun tubes . . . by using the cutting oils recommended by a Gulf Industrial Lubrication Service Engineer, a subcontractor for a large U. S. Arsenal obtained outstanding improvements in production and tool life in connection with boring and reaming operations on centrifugally cast 105 mm. gun tubes of silico-manganese steel.

* * * *

Machine guns . . . a manufacturer of machine guns had difficulty in heat treating gun parts of S.A.E. 1095 Steel. A water quench was too severe, causing excessive rejects due to distortion and cracking. With ordinary quenching oil, the necessary hardness could not be obtained. Consulted on this problem, a Gulf Industrial Lubrication Service Engineer recommended a revolutionary new quenching oil—Gulf Super-Quench—which achieved the proper hardness without distortion. Result: rejects entirely eliminated, immediate increased production for our armed forces.

* * * *

Shells . . . a manufacturer of 75 mm., 105 mm., and 155 mm. shells increased production and lengthened tool life by following the recommendations of a Gulf Industrial Lubrication Service Engineer.

* * * *

Shell fuse plugs . . . by using the cutting oils recommended by a Gulf Industrial Lubrication Service Engineer, a manufacturer of aluminum fuse plugs for shells stepped up production and improved finish.

* * * *

Machine tools . . . a large manufacturer of automatic screw machines increased production as much as 100%, obtained up to 300% increase in tool life, and secured much better finishes in machining operations on various parts by adopting the recommendations of a Gulf Industrial Lubrication Service Engineer.

GULF OIL CORPORATION · GULF REFINING COMPANY

Gulf Building, Pittsburgh, Pennsylvania

GULF INDUSTRIAL LUBRICATION

Call in a Gulf Lubrication Service Engineer to help step up your production

Raise the operating standards of your machines—bring Victory nearer; redesign to get in more Timken Bearings. You also will find this a big advantage in meeting post-war competition.

Typical of the urgent need for doing things quicker and better these days and of the value of Timken Tapered Roller Bearings in accomplishing them is this giant cylinder honing machine.

It was designed and built by the Cooper-Bessemer Corporation for finishing the cylinders of Cooper-Bessemer gas and diesel engines and compressors.

Cylinders up to 30" in diameter can be precision honed on this machine which has a stroke of from 6" to 90"; infinitely variable spindle speeds from 12 to 90 R.P.M.; and spindle reciprocation from 0 to 60 feet per minute (infinitely variable).

Power is supplied by 6 electric motors as follows: main drive, 50 H.P. variable speed; hydraulic pump, 15 H.P.; hone guide, 1 H.P.; coolant pump motor, ¾ H.P.; lubricating oil pump motor, ½ H.P.; hydraulic fluid volume control motor, ½ H.P.

Timken Bearings are used in the gear box, right angle drive, ram assembly and table wheel mounting.

The machine is 32 feet high and weighs 60,000 lbs. Machine table capacity 25,000 lbs.

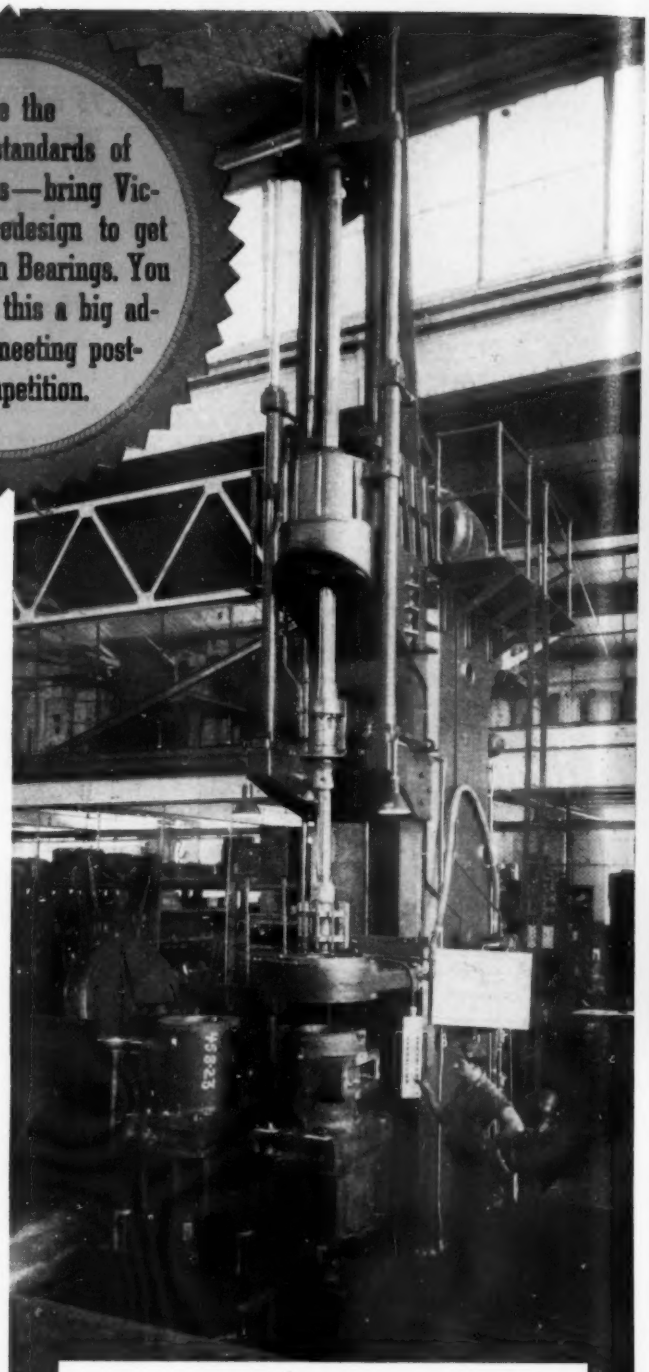
THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN

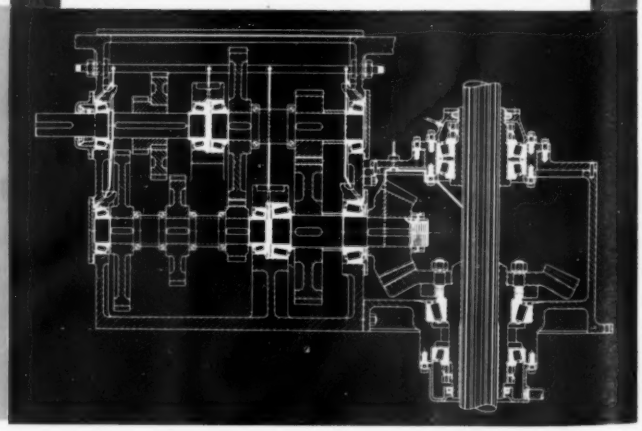
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

"All There Is In Bearings"



Application of Timken Bearings in the gear box of the Cooper-Bessemer Honing Machine.



HELP ASSURE VICTORY

Buy War Bonds. Conserve Rubber. Eliminate Unnecessary Travel. Use the Telephone Only When Important. Salvage All Scrap and Waste Material.

All Timken Bearing production now goes into fighting machines. However, the Timken Bearings in your motor vehicles or industrial machines will see you through the emergency—and beyond it—if you make sure they are lubricated and inspected regularly.

Put Your Screw Driver Army on the DOUBLE QUICK

CUT DRIVING TIME IN HALF!

In today's battle of production, probably more workers are armed with screw drivers than with any other single tool.

Think how many workers in YOUR plant are driving screws . . . and how much time and labor would be saved if you could help them to *drive screws twice as fast!* Chances are you CAN! Hundreds of plants have done just that, by switching to Phillips recessed head Screws.

The scientific centering of driving force in the Phillips Recess eliminates all the handicaps to speed: the fumbling, wobbly starts . . . skidding drivers . . . re-driving of slant-driven screws . . . removal of broken-head screws . . . reclaiming of marred parts. Fast, faultless driving becomes automatic, even for "green hands." Power driving becomes practical for most jobs.

They cost less to use! Compare the cost of *driving* Phillips and slotted head screws. You'll find that the price of screws is a minor item in your total fastening expense . . . that it actually costs less to have the many advantages of the Phillips Recess.

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

PHILLIPS *Recessed Head* SCREWS

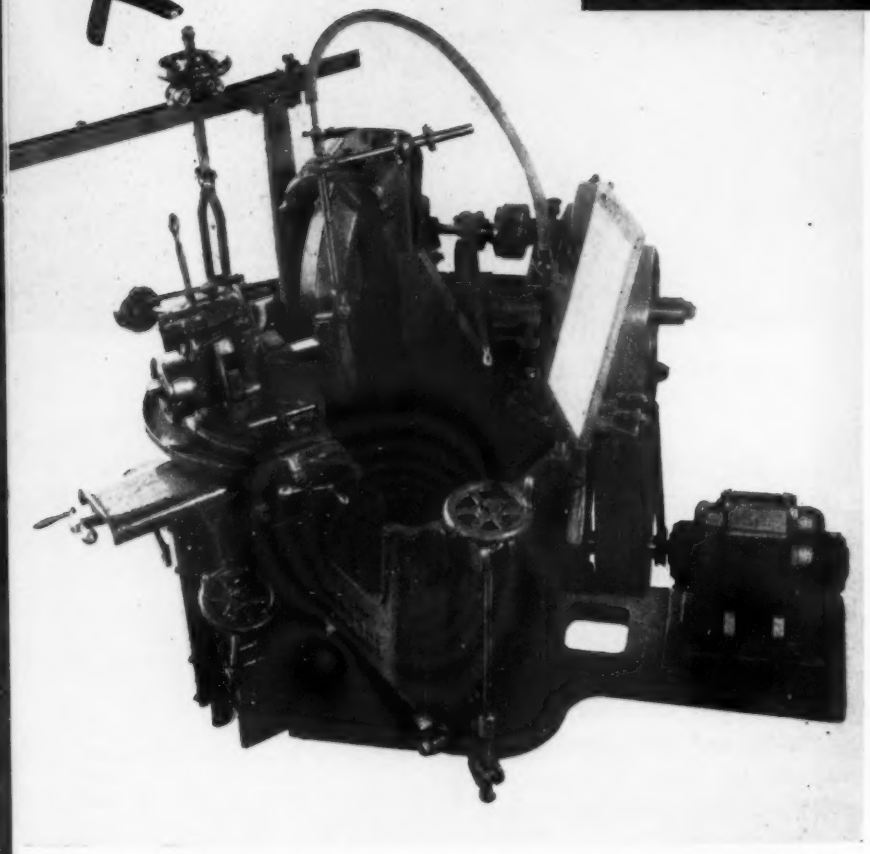
WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

The Grinder Keeps 'Em Cutting The Girl Releases a Man

MARY JANE BLACKBURN OPERATES A SELLERS 6T-TOOL GRINDER IN THE SELLERS TOO



SELLERS HEAVY DUTY TOOL GRINDING MACHINE SHOWING CENTRALIZED CONTROLS

THE SELLERS Heavy Duty Tool Grinder versatile, high production precision grin machine for the modern tool room. It will g any cemented carbide or high-speed steel, stra or convex, curved faced tools, including th tools, at any angle of thread or pitch, interna external, and will accurately reproduce the des angles and clearances on all the tools. It eff savings in tools by removing the minimum amo of tool material, in production costs, by proc ing the exact shapes required to maintain h cutting speeds and in grinding time, by m rapid shaping and sharpening.

The simplicity of even the heaviest of the Sel Tool Grinders and the accuracy with whic reproduces the exact shape, rake, and clear angle at the cutting edge make it possible women operators to keep up with the requ ments of the busiest tool room, thus releasing m for skilled machine work or for the armed for

Sellers Tool Grinders are thus doing double d on the production front.

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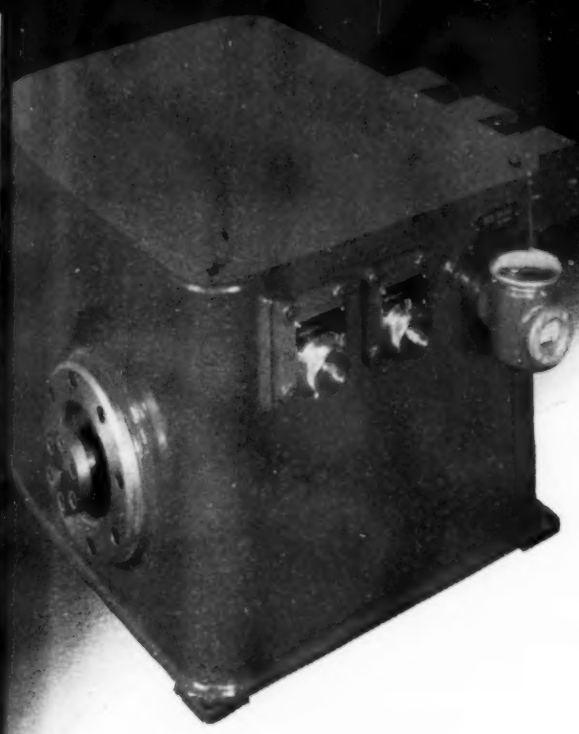

The power unit illustrated controls six cylinders on a special contour milling machine—four of which are rapid traverse feed and return . . . two are for clamping. The unit provides a complete automatic machine cycle controlled by push buttons and limit switches, which in turn actuate solenoid operated valves. Feed rates are infinitely adjustable throughout the range of the feed control valves.

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with the NEW BARRETT COMBINATION STERILIZER AND SEDIMENTOR for CUTTING OILS . . . .

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The NEW BARRETT STERILIZER AND PRECIPITATOR combines these two operations in one piece of apparatus which can be depended on to handle both operations effectively, efficiently and economically. Sterilization is by heat and is a positive active operation in the line ahead of the supply tank. By locating in this position, contamination is intercepted before the cutting oil is conditioned for safe, bacteria-free reuse.

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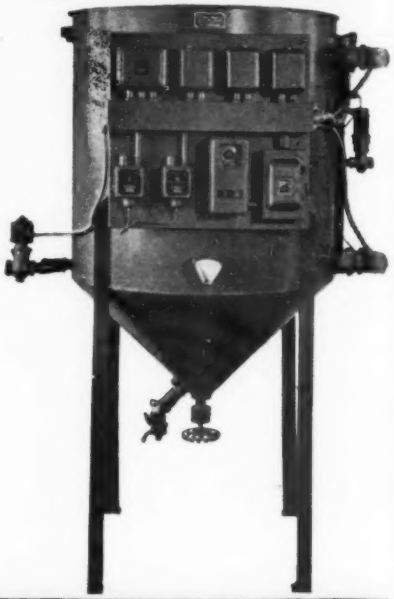
By thoroughly and constantly sterilizing and effectively removing solid matter, the Barrett Combination Sterilizer and Sedimentor reconditions cutting oil for reuse; sterilized for safety's sake and abrasive-free for longer tool life.

Barrett Sterilizer and Sediment Precipitator arranged for fully automatic operation.



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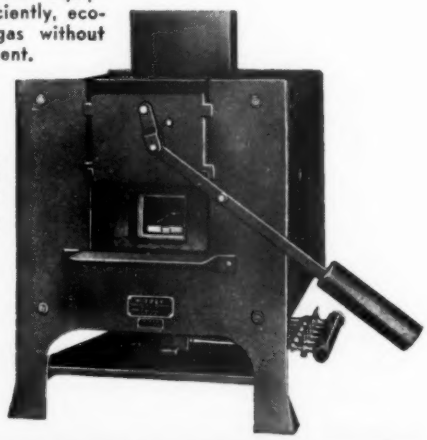

HIGH SPEED MUFFLE FURNACES (RIGHT)

These BUZZER "Super Heat" Furnaces —for heat treating high speed and alloy steels—will heat to 2400° in 1½ hours. Insulated with high grade fire brick; ruggedly constructed; full muffle design. Quiet, efficient, economical, protective atmosphere.

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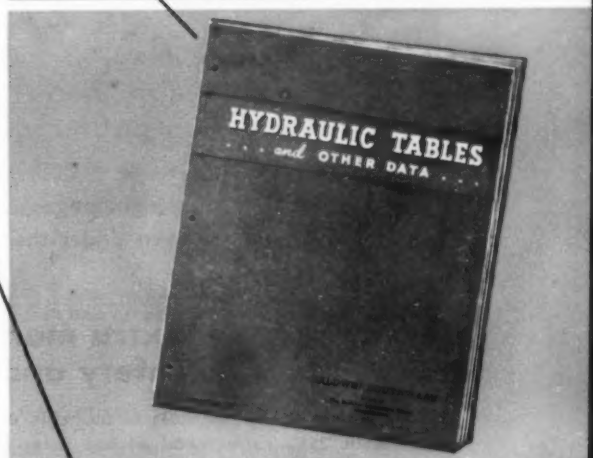

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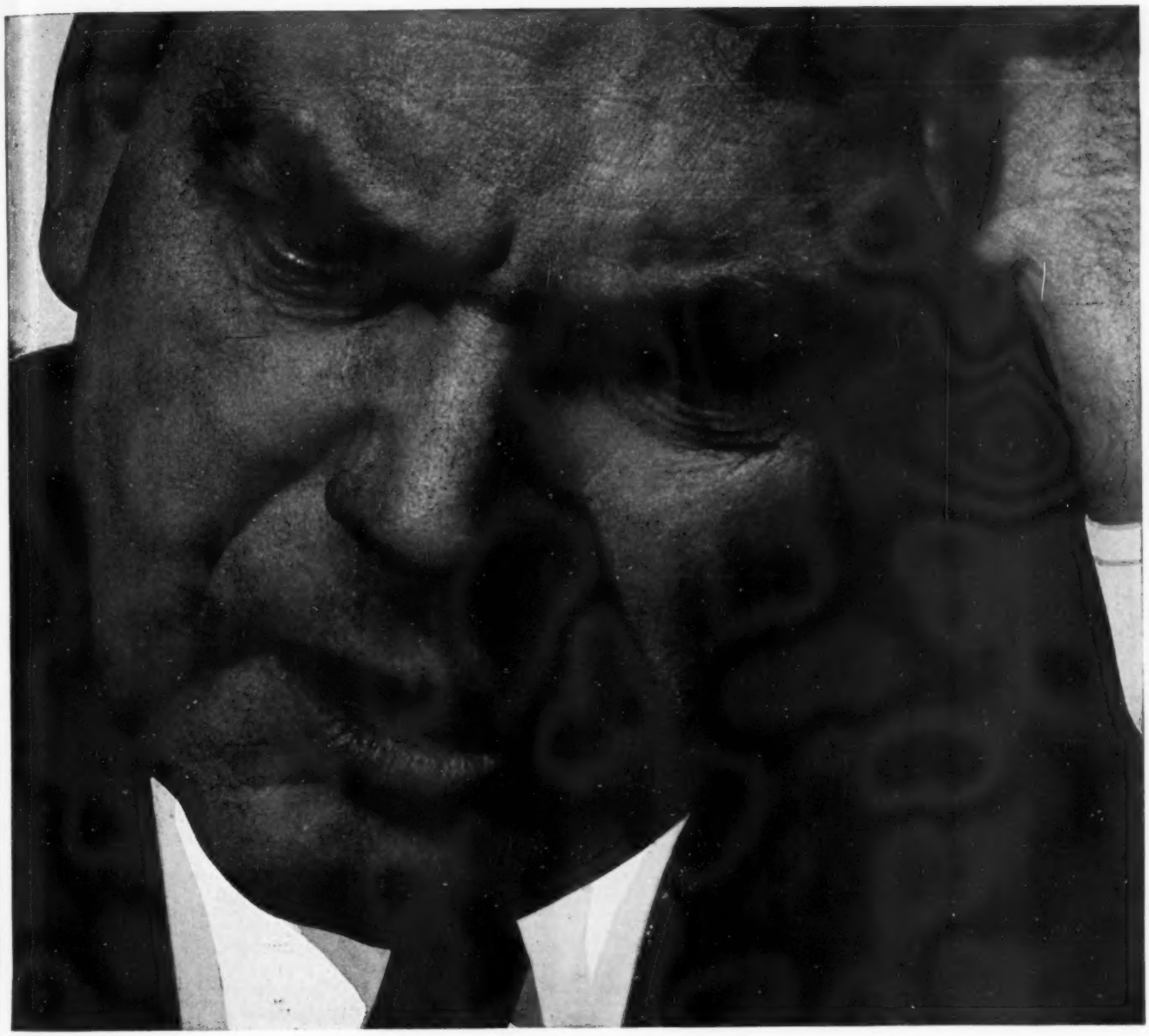

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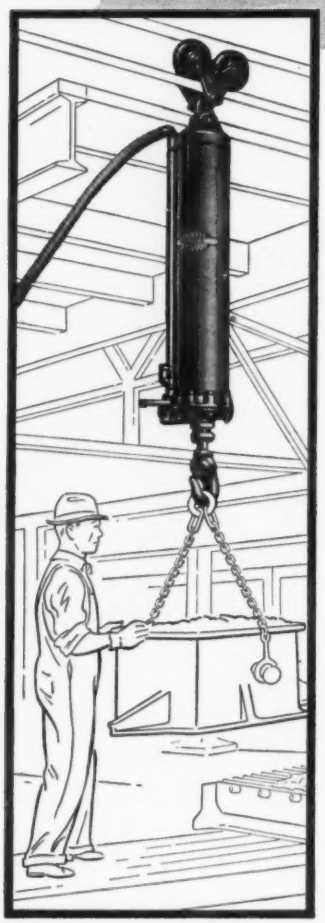
CURTIS AIR HOISTS



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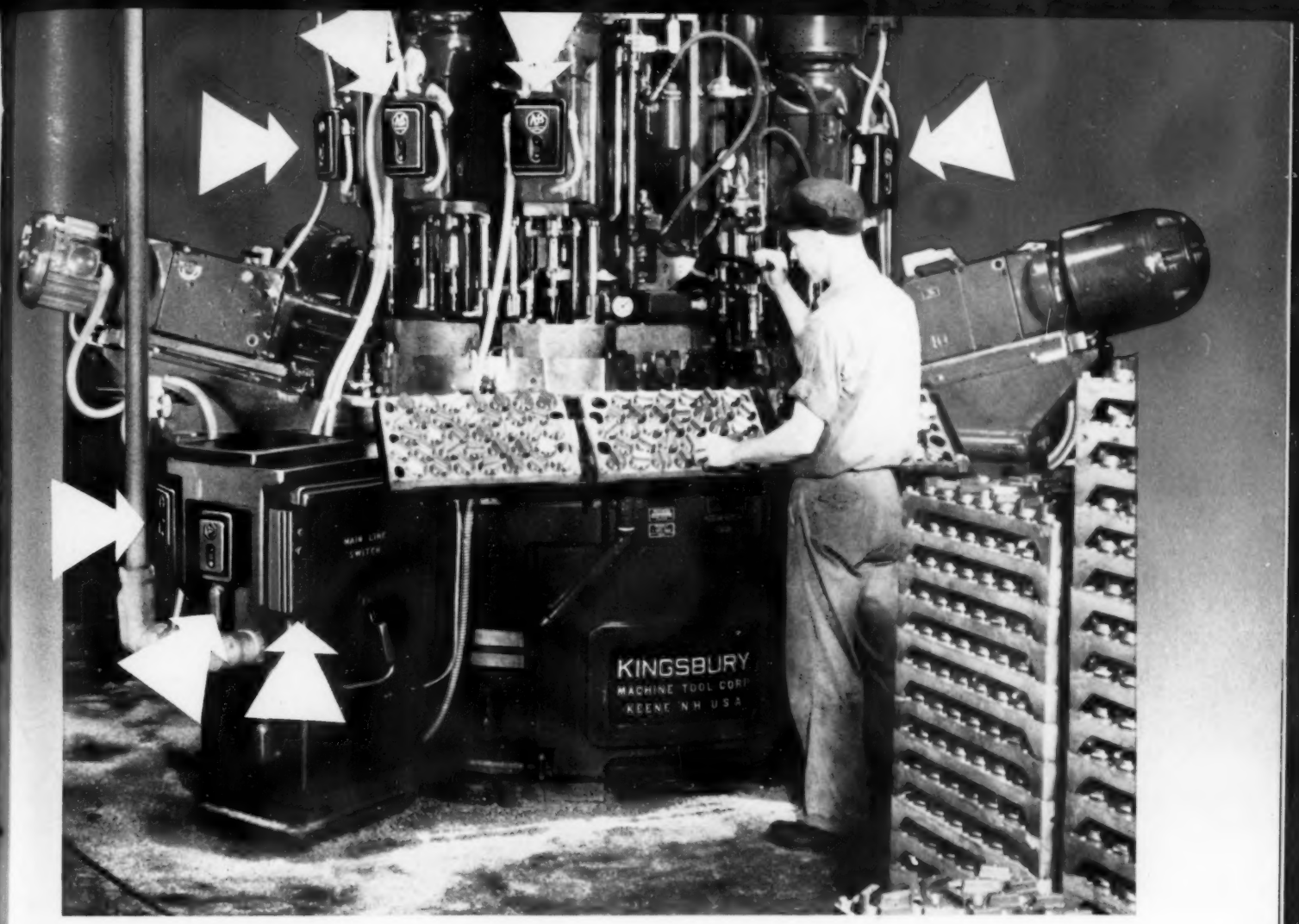

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Production machines require automatic controls. For safe, positive sequence control, the contactors must perform consistently. No variations in opening and closing times can be tolerated. The precision operation of automatic machines depends upon the precision of their controls. Oscillograph tests of Allen-Bradley solenoid controls have repeatedly demonstrated their superiority in consistent switching performance. Their double break, silver alloy contacts never need maintenance. The absence of pivots, pins, hinges, and jumpers explains why they are good for millions of trouble-free operations. That's why you find A-B controls where Production is a MUST!

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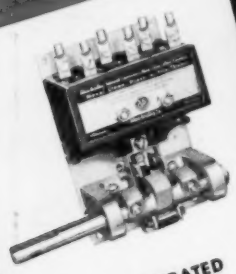

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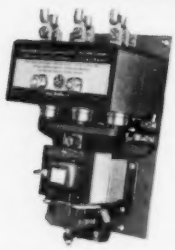
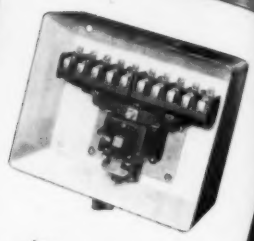
For mechanical switching of motor control circuits.

SOLENOID OPERATED
For electrical switching of motor control circuits.

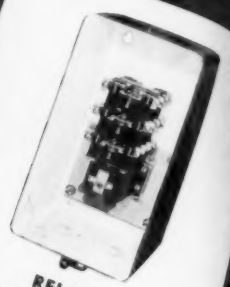


RESIDUAL HOLD-IN
No hold-in current is required. Held by residual magnetism.



MULTI-POLAR
Takes place of several contactors. Simplifies control panels.

ENCLOSURES
A-B contactors available in all standard NEMA enclosures.



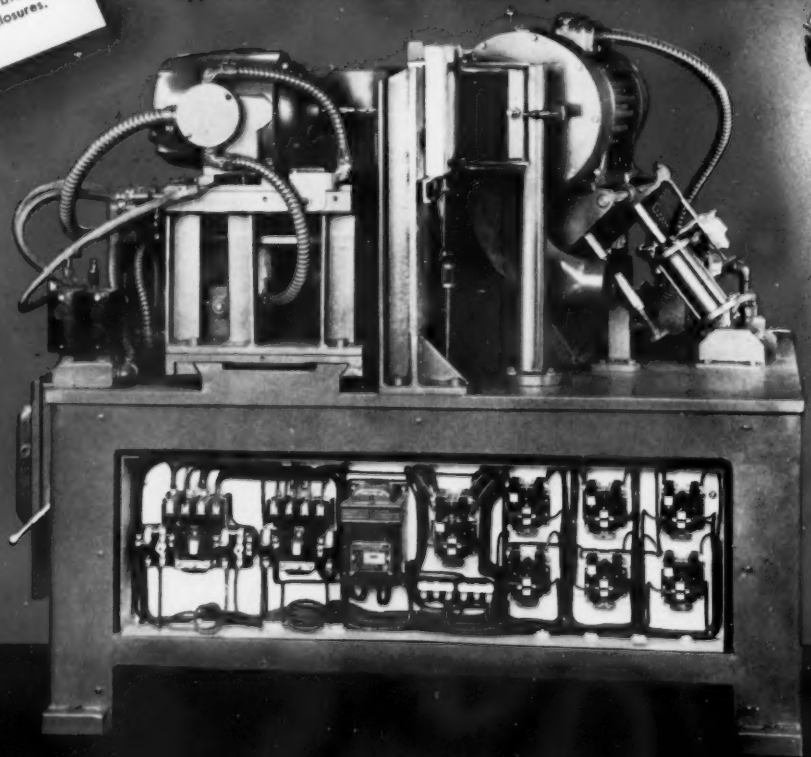
RELAYS
Furnished as standard in over 300 contact combinations.

Idea No. 1—A cam-operated contactor . . . actuated mechanically with cam on horizontal drive shaft. Ideal for frequent switching cycle service on automatic machines.

Idea No. 2—Solenoid contactors and relays . . . available in several hundred contact arrangements and ratings. Suitable for all types of machine controls.

Idea No. 3—Solenoid contactors with residual magnetic hold-in . . . require no magnetizing current to hold in after closing.

All A-B contactors are equipped with patented silver alloy, double break contacts which require no maintenance.



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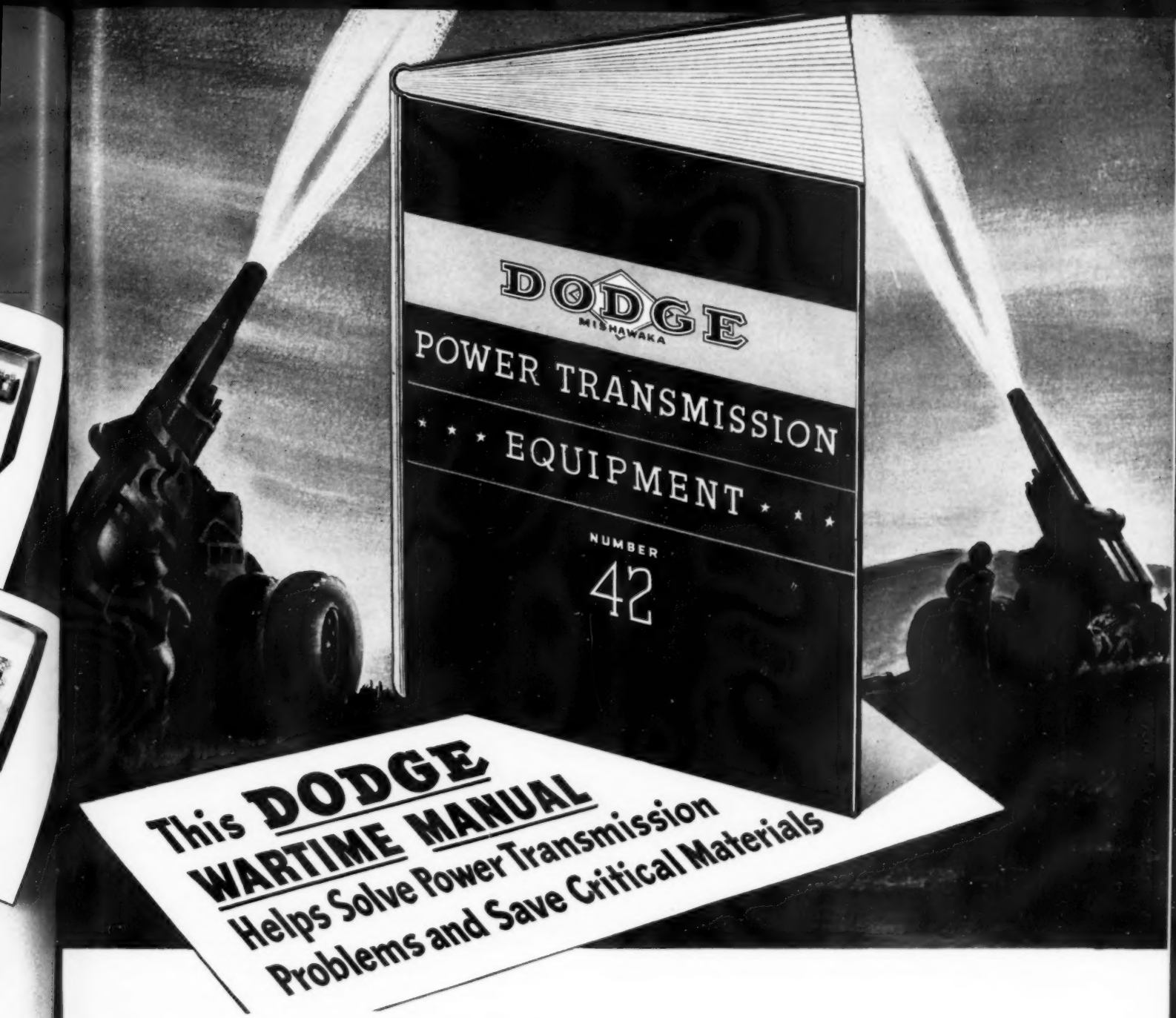

This DODGE WARTIME MANUAL Helps Solve Power Transmission Problems and Save Critical Materials

THIS Dodge Wartime Manual of Mechanical Power Transmission has been compiled to assist in solving wartime power problems — to conserve power, increase production and save critical materials.

It is being released at a time when conservation of motors, power and critical materials is of vital importance. It is the "How Book" of the Dodge program aimed at helping industry to increase production — built around the fighting slogan — *"put all your power in the job."*

The new Dodge catalog offers alternate power transmission appliances that save critical metals — and help to throw more scrap into the fight. It presents power transmission equipment that steps up production — saves time —modernizes and increases productivity of present equipment — quickly — economically — effectively.

Between the covers of this new catalog, you will find "The Right Drive for Every Job" — Dodge D-V drives — bearings — pulleys — clutches and other power transmission appliances designed for use on individual, multi-motor and modern group drives.

Modern planned mechanical power transmission is a potent weapon ready *now* to wage war on power and material waste — to get more battle power out of horsepower.

Write today on your firm letterhead for the Dodge Wartime Manual of Mechanical Power Transmission.

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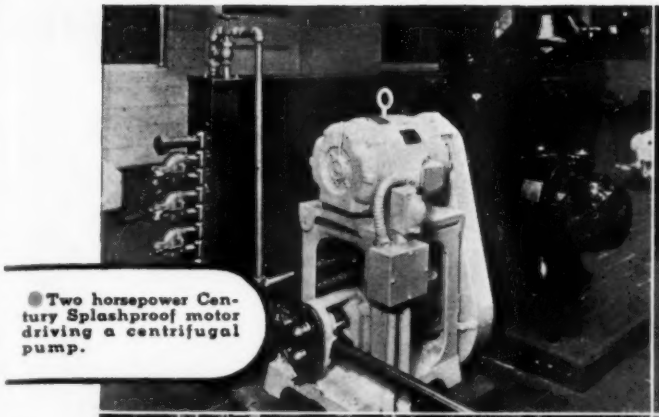
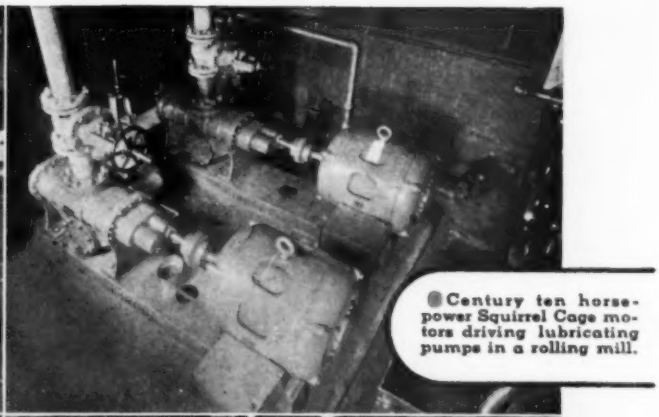
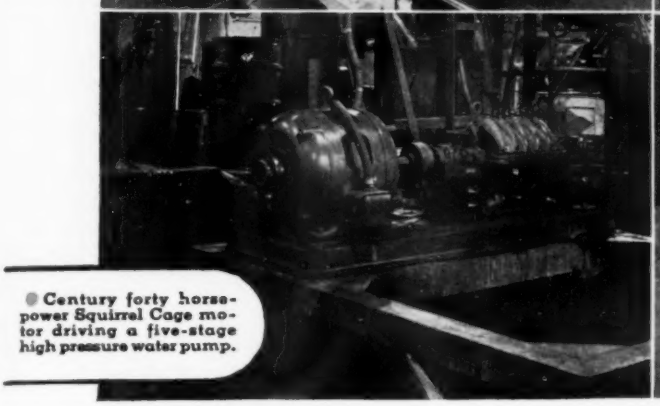


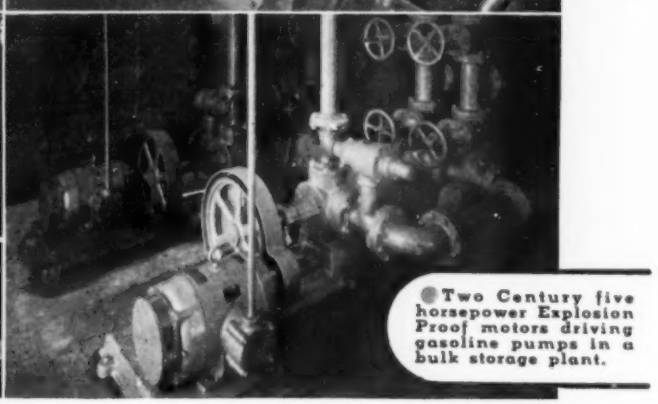
Two horsepower Century Splashproof motor driving a centrifugal pump.



Century ten horsepower Squirrel Cage motors driving lubricating pumps in a rolling mill.



Century forty horsepower Squirrel Cage motor driving a five-stage high pressure water pump.



Two Century five horsepower Explosion Proof motors driving gasoline pumps in a bulk storage plant.

CENTURY MOTORS Meet Your Centrifugal or Reciprocating Pumping Application Requirements In All Types of Atmospheres—on Land or Sea

There's the *right* Century Motor for these and many other pumping requirements:

Water	Gasoline
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Lubricating Oils and Coolants
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—properly protected against these surrounding conditions:

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Dusts
Coolant Spray
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Moisture
Explosive Grain Dusts (Class II, Group G)
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304

Century Motors are built to meet practically every type of pumping application efficiently and effectively — on land or sea.

Depending upon the surrounding operating conditions, pump installations may require *Century Open, Drip Proof, Splash Proof, Totally Enclosed Fan Cooled, or Explosion Proof Motors.*

To assure peak performance, it's important to select the Century Motor with the proper electrical characteristics. These may vary from low starting torque—low starting current for centrifugal pumps, to high starting torque — normal starting current for reciprocating or gear pumps and for starting other dead load applications.

Century MOTORS

Help You Beat the Production Promise

As in other fields, Century's wide range of motor types and sizes makes it an easy matter to apply the correct motor to pumping uses—motors which match the type of liquid pumped, the pressures desired, and the surrounding working conditions. Your nearest Century Application Engineer and Service Organization will gladly help you with any pumping problem. Call him in today.

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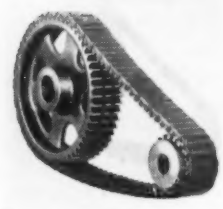
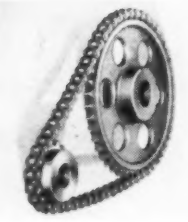
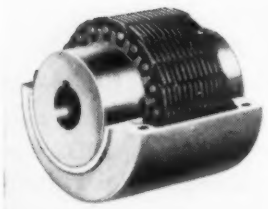
MORSE Makes Both . . . SILENT and ROLLER CHAIN DRIVES

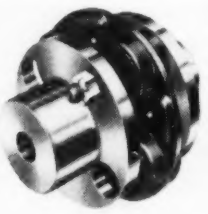


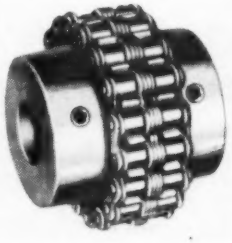
Morse Silent Chain Drives operate at practically 100% efficiency, year after year. Quiet and smooth in operation, they insure maximum machine output. The Morse principle of "Teeth, Not Tension," means no slip—no wasted power. Wide range of chain capacities.

Morse Roller Chain Drives are equipped with effective "oil feed" system in every link. This exclusive design gets oil to the heart of chain. Oil gets in, wear stays out! They last longer, require less maintenance. Interchangeable and available in single and multiple widths.









Morse Silent Chain Couplings compensate for shaft misalignment. This simple and rugged coupling consists of two facing steel sprockets wrapped with Morse Silent Chain—enclosed in a machined split case. Links acting on sprocket teeth form flexing medium. They are easily installed and available in many sizes.

Morse Morflex Couplings contain two steel hub members and a floating center unit assembly to which each hub is separately connected through resilient rubber trunnion blocks. There is no metal on metal movement. Rubber allows for maximum distortion without loss of efficiency. Cuts maintenance cost.

Morse Roller Chain Couplings embody many outstanding features that make for unusual flexibility and long-life. Highly compact, they consist of two facing sprockets wrapped with Morse Roller Chain. Easy to install and align. Wide range of stock and special sizes—covers if desired. Send for coupling data today.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE positive DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.

DOW

Dow operates extensive fabrication facilities for the manufacture of Dowmetal castings and wrought products. These activities are supplementary to Dow's production of magnesium, which began 26 years ago with the extraction of this lightest of structural metals from the brine of Michigan wells and is now augmented by the recovery of magnesium from sea water. Thus every effort is being made to meet constantly increasing demands for a strategic material that is essential to the construction of our airplanes.

DOWMETAL

MAGNESIUM

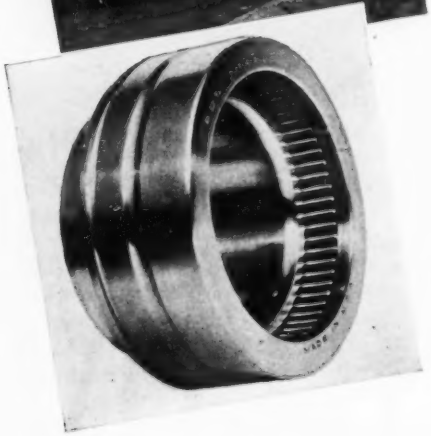
THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

PRODUCER OF THE LIGHTEST OF LIGHT METALS SINCE 1916

INGOT • CASTINGS • FORGINGS • SHEET • STRIP • PLATE • EXTRUSIONS

"ALL ROADS LEAD TO ROME"

...and Berlin



GALION and RBC

are teamed up for the job

Wherever they are, all roads, air base runways and landing fields are built with one purpose—to smooth the way for speedy transport of men and materials, for the safe takeoff and landing of planes—all of which are destined to play a part in the complete capitulation of the Axis. Galion 3-wheel, portable and tandem Rollers are equipped for this heavy duty with RBC Roller Bearings whose anti-friction and high load carrying characteristics provide for smooth operation, long life and minimum maintenance.

ROLLER BEARING CO. of AMERICA

TRENTON . . . . NEW JERSEY

NEW LINDBERG MOVIE OFFERS MANY PRACTICAL

FOR HEAT TREATERS!

The "Second Edition of Heat Treating Hints" will be available for booking on February 1st, 1943. This 16mm, color and sound, film shows 45 minutes of valuable heat treating tips, such as:

A simple method of scale-free hardening when an atmosphere furnace is not available ★ A number of basic quenching suggestions ★ Scale-free hardening of tools and dies in a molten boric acid bath ★ How to shrink a draw ring back to serviceable life after having been worn beyond useful tolerance ★ The old blacksmith trick of tempering springs by igniting the adhering quench oil ★ The problems of the "most promising apprentice" when he tries some of the jobs in the shop.

You will see many other practical, useable suggestions on heating, quenching and straightening presented by the editors of "Heat Treating Hints," the publication.

A simple method of scale-free hardening when an atmosphere furnace is not available.

OUR STUDIO The scenes were laid in the world's largest commercial heat treating plant, where more than 5,000,000 pounds of metal are handled each month. The actors are the men who supervise the treating of this tremendous volume of work. You will see them at the furnaces, quench tanks and straightening presses, going through each problem, step by step.

WHO SHOULD SEE THIS FILM . . . heat treaters, metallurgists, tool and die makers and designers, superintendents, plant managers and trainees in the metal working industry. Anyone who works with metals will have a much better appreciation of the problems of heat treatment *and the solutions to many of them.* The film is purely educational and *contains no advertising.*

Scale-free hardening by protecting the surface with molten boric acid.

Shrinking a draw ring back to serviceable life after having been worn beyond useful tolerance.

LOANED WITHOUT CHARGE Both the First and Second Editions of the "Heat Treating Hints" movie are loaned without charge to any interested group. Write today for the folder giving details on how your plant or society may obtain this educational, entertaining film.

HEAT TREATING HINTS
FIRST EDITION

To date, this 16 mm, color and sound film has been shown in over 150 cities in the United States and Canada to audiences totalling more than 65,000 people. Prints have been purchased outright for training purposes by branches of our armed forces.

The First Edition is still available for booking. See it, as well as the Second Edition. Both are complete, instructive, entertaining units with no duplication of scenes.

LINDBERG ENGINEERING COMPANY
2445 WEST HUBBARD STREET • CHICAGO

LINDBERG FURNACES

SUPER-CYCLONE FOR HARDENING, NORMALIZING, ANNEALING, NITRIDING AND TEMPERING
HYDRYZING FOR SCALE-FREE AND DECARB-FREE HARDENING
CYCLONE FOR ACCURATE, LOW COST TEMPERING

MORE PRODUCTION with LESS TOOLS

McCASKEY TOOL CRIB CONTROL

PREVENT CRIBS FROM BECOMING PRODUCTION BOTTLENECKS

• With McCaskey Control in your cribs, you know in a moment at any time what tools are available, whether they are in the bins or have been loaned to employees. You know that those in the crib are ready for immediate use, reconditioned or sharpened if necessary—where the others are and when they were issued. The results are faster, more accurate production, fewer scrapped parts and less idle time between jobs. Instead of being a production bottleneck, the tool crib becomes a real service to production.

SKF Industries, Phia., Pa., reports —"Our records (using the McCaskey System) provide the basis for determining that the correct tool is available in good condition for each job and that it is not misused by careless workmen."

KEEP CRIB INVENTORY IN LINE WITH TOOL TURNOVER

• Numerous experiences with McCaskey Control have shown that most crib inventories can be reduced from 25 to 50%; and at the same time provide a surplus of items that are difficult to secure today. The exact requirements necessary for maximum production are easily and quickly determined from the monthly usage or turn-over of inventory tool items. Totally inactive items can be salvaged or passed on to some plant more urgently in need of them. McCaskey assures busy shops with a dependable system for keeping costs down.

A. O. Smith Corporation, Milwaukee, Wis., has the following to say about inventory reduction with McCaskey Tool Crib Control: "Four cuts in two years, totalling approximately $9,000 . . . close check on tools seems to aid in drawing out of their hiding places tools of which all trace had been lost."

• • •

Whether you have one or a dozen tool cribs, investigate the simplicity and effectiveness of McCaskey Control for assuring MORE PRODUCTION WITH LESS TOOLS.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

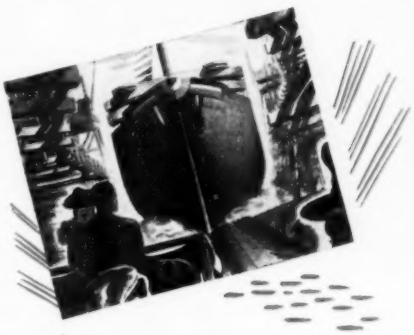
McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

NEW LIBERTY SHIP ENGINES

from scratch in 90 days

. . . with Old Machines Equipped with REEVES Variable Speed Drives



A group of industrialists in a West Coast city wanted to help meet the government's call for more ships. They had a plant—they had the experience—they had the backing. They were offered an order for triple-expansion main propulsion engines for Liberty Ships. But, they didn't have enough machine tools—and new tools were not to be had. There was no time and little material for building new tools. So they took old, obsolete machines—the only kind they could get—equipped many of them with REEVES Variable Speed Drives for complete speed adjustability, and went to work.

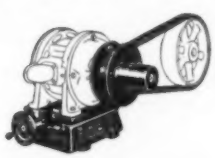
Within 90 days the first engine was delivered. Today a steady stream of engines is being turned out. This record is certainly a tribute to American ingenuity and resourcefulness, and REEVES is proud to have had a part in it. . . . Booklet MG-423 gives other examples of how REEVES drives give old machines greater precision and help new operators save time and material. Write for it.

REEVES PULLEY COMPANY
COLUMBUS, INDIANA

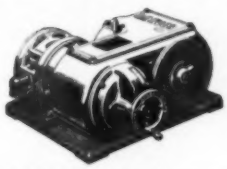
Views of plant featured in this advertisement, showing lathes equipped with REEVES Variable Speed Drives. Approximately 20 REEVES units are in use in this one plant, including the Motodrive, Transmission, and Vari-Speed Motor Pulley.

THE 3 BASIC UNITS IN THE REEVES LINE

VARIABLE SPEED TRANSMISSION for infinite speed adjustability over wide range—2:1 through 16:1. Fractional to 87 h.p.



VARI-SPEED MOTOR PULLEY for application to shaft of any standard constant speed motor; 3:1 range. To 15 h.p. Forms actual drive to machine.



MOTODRIVE—Combines motor, variable speed drive and gear reducer (if needed) in one compact unit. To 10 h.p., speed range 2:1 through 6:1.

REEVES *Accurate Variable* Speed Control

YOUR COUNTRY *NEEDS*
MORE DOLLARS *TO WIN!*

The United States has got to have more dollars than regular war bonds, personal income taxes, corporation taxes can bring in.

Contribute Your Share Now!

VICTORY BOND DRIVE

★

IF *Steel* WERE *Gold*

MAYBE a gold tool, or a gold die, or a gold fixture would not be of much use to you. It's a good bet, though, that if an old one were lying around—on a top shelf, in a dark corner, or under a work bench —well, it wouldn't lie there long!

Yes—"getting in the scrap" would be no problem if steel were gold. . . . And yet, by any true standard of value, steel today is worth far more than gold.

With your steel scrap you can purchase victory. With your steel scrap you can guarantee a continued supply of the tools you need to give our fighters the tools they need!

Gold is the coinage of commerce — but steel is the currency of freedom!

W. O. BARNES CO. INC.
DETROIT MICHIGAN

A Barnes Blade is Better

Introducing

The New

Monitor

THERMALOAD V

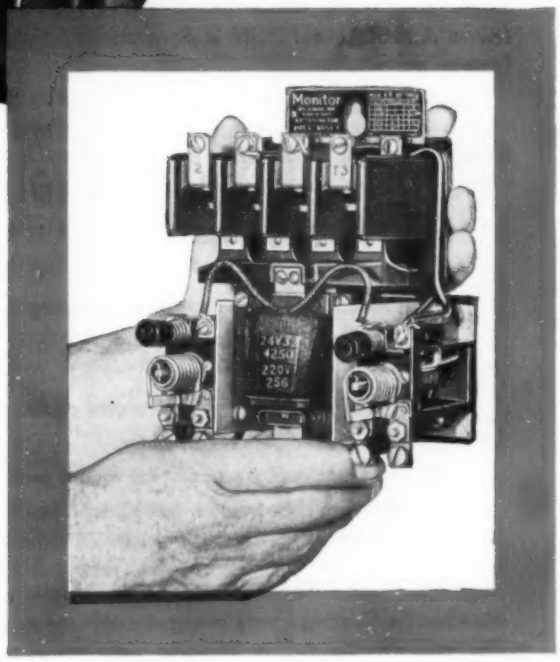
SOLENOID STARTER

Here is a solenoid starter that gives you the kind of protection you need. Because into this sturdy, compact unit, is built a feature that has proved its worth over years of service in larger Monitor installations—a feature that Monitor originated—the Monitor Compensated Thermal Overload Relay. Extremes in ambient temperature will not affect its performance! The trip *always* occurs in the same time at a given percent overload. Full overload protection for your motor is assured regardless of installation characteristics.

Other features include: Vertical, Straight-line Design . . . Resilient, Shock-proof Mounting for quiet operation . . . Double-Break, Silver Contacts . . . Easily-Interchangeable Coils. And—Monitor quality construction throughout—your assurance of longer, more satisfactory performance.

For original equipment and for replacement—specify the starter that meets today's needs—the Monitor Thermaload V.

For further details and delivery dates, write us today.



5¾ ins. x 5¼ ins. x 4⅛ ins.

These small over-all dimensions indicate better, more compact design. They permit installation in smaller spaces. Available in five sizes—1.5 to 7.5 H.P. 110 to 550 V. (A.C.) Fully approved by Underwriters.

The Monitor Controller Company

LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

ABSCO MEEHANITE CASTINGS IN PLACE OF...

Inquiries are received almost daily from manufacturers asking if they can use ABSCO Meehanite in place of certain forgings or other cast materials containing critical alloys which are becoming more and more difficult to obtain. In many cases the answer is "YES!"

If you are faced with such a problem, regardless of what material you have been using, ABSCO Meehanite Castings may be the solution. Many manufacturers have found ABSCO Meehanite a permanent improvement over former materials used.

There are 21 types of ABSCO Meehanite Castings, providing an extensive range of physical properties which bridge the gap between steel and cast iron and meet a wide variety of other industrial service requirements.

Through our Selective Processing, a type of ABSCO Meehanite is available to meet these and other requirements:

1. **Strength, toughness and high damping capacity.**
2. **Ability to stand shock or strain.**
3. **Free machining qualities.**
4. **Density and solidity for pressure castings.**
5. **Heat and corrosion resistance.**
6. **Freedom from warpage that means constant alignment.**
7. **May be heat-treated for higher tensile strengths and increased resistance to wear.**

Regardless of what material you are now using, ABSCO Meehanite Castings may present qualities and advantages that will enable you to improve your product. You will be under no obligation by finding out! Write for hand book.

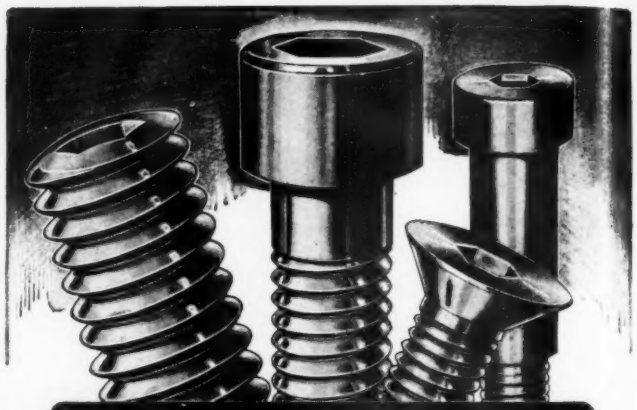
3180

THE AMERICAN BRAKE SHOE AND FOUNDRY COMPANY

BRAKE SHOE AND CASTINGS DIVISION

FOUNDRY
MAHWAH
NEW JERSEY

OFFICES
230 Park Avenue, New York, N. Y.
332 South Michigan Ave., Chicago, Ill.



ALLENS' QUALITY PERSISTS

IT STAYS on the level of our all-time *high* in strength of material, thoroughness of heat-treating, accuracy of threading. Not one characteristic of Allen screws has changed except for the better.

Production-gains have *all* been scored by improved manufacturing processes; not in a single case by cheapening the product.

Step-by-step inspection standards have been *more* intensively applied, not less. So that everything "Allens" have had they have NOW. And every quality that's won your preference will continue to *hold* it.

Order only through your local Allen Distributor — the man who gets you the goods to the LIMIT of the supply!

THE ALLEN MFG. COMPANY
HARTFORD, CONNECTICUT, U. S. A.

then I said to myself—

EVERY WELDING INCH IS A "BIG INCH"

It's "BIG INCH" or Blockade for Your Business

"Big Inch" didn't just happen — Nazi subs FORCED it — by sinking tankers right and left —just when war industries and armed forces had zoomed demands on the East Coast. We had to do something BIG and QUICK.

ALTER EGO: Right! Our torpedo-firing "competition" forced our hand — forced us to build "Big Inch"—world's largest pipe line — 24″ diameter, 1500 miles of it—big enough to pour 300,000 bbl. East Texas oil daily to the East Coast—equal to *150* 10,000-ton tankers.

And the record speed for building this record pipe line is made possible by welding.

ALTER EGO: Well, it's just the same story of competition with ships, planes, tanks, guns and all the other SPEED RECORDS made possible by welding. Competition forces progress.

But, what will take the place of present "competition" to FORCE the same records in speed, lower costs and improved designs in the post war Battle for Business?

ALTER EGO: Just plain sales competition will force change-over to the "Big Inch" method of construction. We'll change or we'll face business "blockade"! So we should start NOW on the right-of-way in welding knowledge if we ever *expect* profit in post-war business.

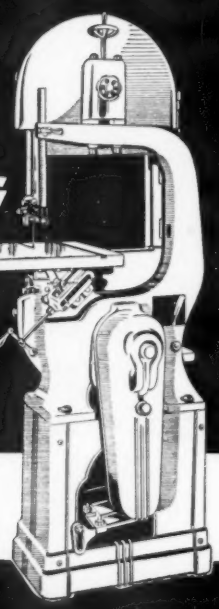
Ask your inner self whether it would be smart to get welding guidance, of "big inch" caliber, right NOW from

THE LINCOLN ELECTRIC COMPANY • CLEVELAND, OHIO

By-pass production line jams—

with walker-turner

METAL CUTTING Band Saws



MANY war plants are getting around production tie-ups by putting versatile Walker-Turner Metal-Cutting Band Saws at congested spots to relieve overworked, heavier cutting machines.

Aircraft plants use them for cutting bomber noses and other bulky members. Die makers profile irregular dies with great time savings. Tool rooms, machine shops and metal working plants find them indispensable for cutting sheets, rods and tubes of steel, iron, aluminum, brass, alloys and compositions—quickly, accurately, economically.

Back-gearing and cone pulleys provide speed range from 61 to 5300 s.f.p.m. Sturdy, compact, easily operated, fully safeguarded. Available in 14-inch and 16-inch models for prompt shipment to war industries.

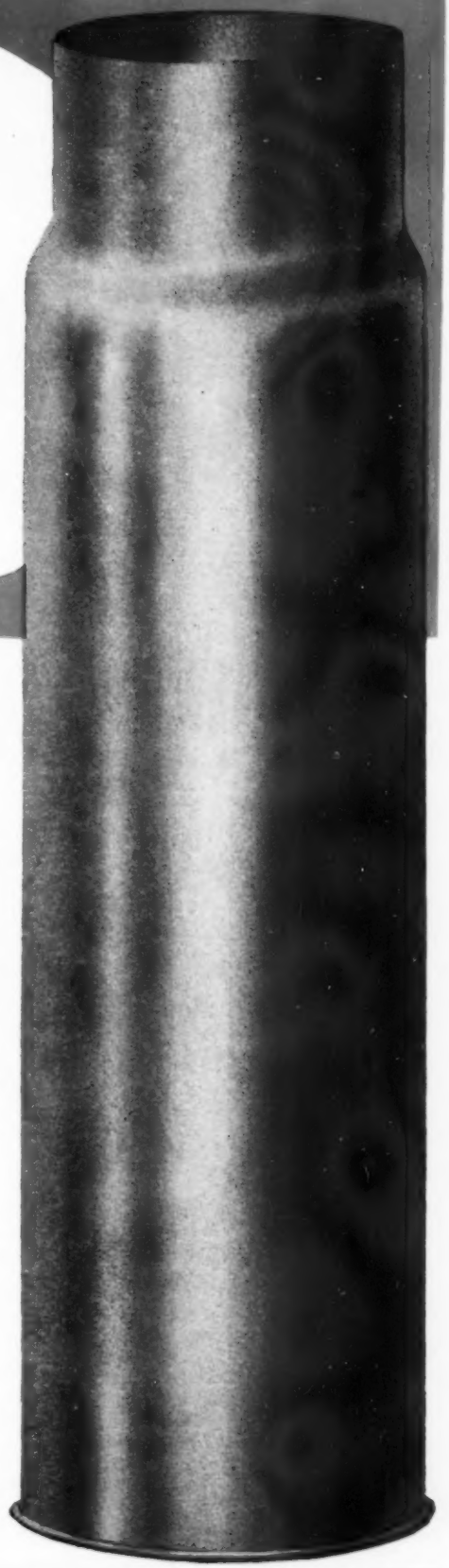
WALKER-TURNER CO., INC.
4513 Berkman St. Plainfield, N. J.

walker-Turner COMPANY, INC. PLAINFIELD, N.J. U.S.A.

MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
RADIAL CUT-OFF MACHINES FOR METAL • MOTORS • BELT & DISC SURFACERS

HELP FOR PLANTS GOING INTO STEEL SHELL CASE PRODUCTION!



It has been our privilege to cooperate with a number of plants now planning for or actually engaged in the production of steel shell cases. In the interests of saving time and speeding production, we offer that experience to any plant engaged in this work.

One problem on which our Technical Service Engineers have assisted is in the drawing operations performed on these cases. In the initial cupping operation, for example, Oakite Drawing Compound provides the right lubrication required, facilitates stripping of work from die, contributes to greatly increased die life.

Quite important, too, is the fact that this Oakite material is readily removed in subsequent cleaning operations. Further research and field work on the various other drawing operations has resulted in the accumulation of data which, we believe, can be used to advantage in a study of your drawing problems.

Oakite experience has also been helpful in degreasing steel shell cases before applying protective finishes. On this operation, fast-working Oakite materials provide the CHEMICALLY CLEAN surfaces required before final finishing.

If we can be of service on any phase of this work or on any of the important operations listed, 'phone, write or wire us today!

LET US GIVE YOU TECHNICAL HELP ON THESE AND SIMILAR OPERATIONS!

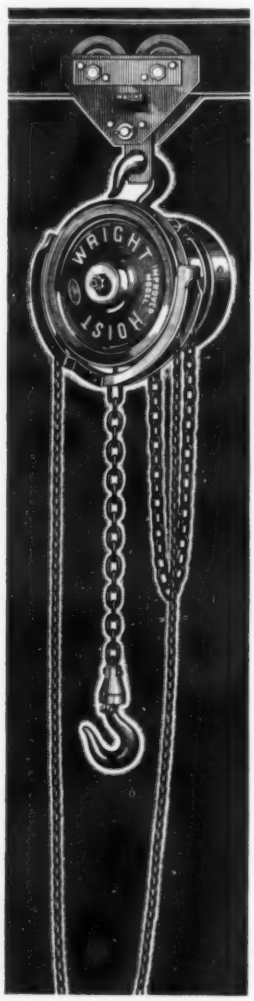
1. Cleaning and preparing shot and shells for painting
2. Machining shell component parts
3. Rust-proofing gun parts between manufacturing stages
4. Degreasing bomb parts prior to plating
5. Cleaning rifles and guns after proof-firing
6. Removing heat treat scale

Manufactured only by
OAKITE PRODUCTS, INC., 24 Thames Street, NEW YORK, N. Y.
Representatives in All Principal Cities of the U. S. and Canada

OAKITE MATERIALS...METHODS...SERVICE

CLEANING FOR EVERY CLEANING REQUIREMENT

DON'T OVERLOAD!



WRIGHT HOISTS are built to carry more than their rated capacities, but like other well-made pieces of mechanical equipment they should not be overloaded. Overloading is dangerous—while today, abuse to machinery is akin to sabotage.

Watch the bottom hook

WRIGHT load hooks are drop-forged from special steel which, when subjected to excessive overloading, give visible warning by opening slowly. When the bottom hook has started to open, look to the top hook, too, for while it is stronger than the bottom hook, it also may be reaching a danger point.

Watch the load chain

WRIGHT HOIST load chains are electrically welded from special analysis steel, exceptionally high in tensile strength and elastic limit. Excessive overloading will stretch the chains out of pitch, thus preventing proper fit with load wheel pockets. This results in destructive wear to both chain and load wheel. Keep your chains well lubricated for long life. Take proper care of your **WRIGHT HOISTS**. You'll find the name of your nearest **WRIGHT** distributor in the telephone book.

In Business for Your Safety

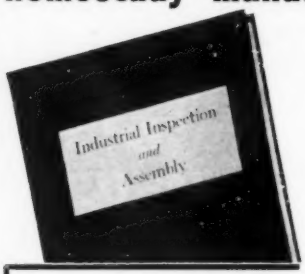
WRIGHT MANUFACTURING DIVISION

York, Pa., Chicago, San Francisco New York

AMERICAN CHAIN & CABLE COMPANY, INC.

BRIDGEPORT, CONNECTICUT

AT LAST . . . a simple, illustrated homestudy manual that helps you



QUICKLY DEVELOP SKILL

in handling and inspecting work in a modern factory

Here are the plain A-B-C's about everyday machining, assembling and inspecting operations that you must know to get ahead in any industrial plant.

The manual first introduces you to the simpler jobs and then progresses step by step to the more advanced, higher-paid classes of work—describing equipment, explaining its use, telling exactly what to do and what not to do, showing you how to use simple mathematics to solve practical problems, giving pointers in blueprint reading, and so on . . .

Just Published!

INDUSTRIAL INSPECTION AND ASSEMBLY

By Edward N. Whittington
Superintendent, Aviation Division
The Delehanty Institute

Both women and men, beginners and experienced workers, will find a great deal of useful information in this book. All thirteen chapters are so clearly written, so down-to-earth, so thorough that reading them is like personally going through a model plant. As you turn each page it is like stopping to talk to the different workers about their jobs, observing how each tool, machine, precision instrument is most efficiently used, seeing how parts are assembled, and watching just how the work is checked and tested.

All the latest facts are covered. Special attention has been devoted to recent advances in factory work. And, up-to-the-minute methods are fully described in the discussion on Production Lines.

241 pictures

are scattered throughout the book's 202 pages. Combined with the clear, careful, concise explanations, they make this manual one of the handiest homestudy courses for men and women who want to do a better job and get ahead faster.

Only $1.75

These 13 chapters packed with practical help

1. **General Factory Rules**
2. **Common Tools; Identification, Care and Use**
3. **Filing, Burring, Scraping, Grinding, and Lapping**
4. **Drilling, Hand and Machine**
5. **Tapping and Reaming**
6. **Shop Mathematics**
7. **Precision Measuring Instruments in General**
8. **Fundamentals of Blueprint Reading**
9. **Inspection with Gages**
10. **Bench Assembly**
11. **Soldering**
12. **The Bench Lathe**
13. **General Organization Breakdown of a Fair-sized Corporation**

Appendix: Useful Tables

10 DAYS' FREE EXAMINATION

McGraw-Hill Book Co., Inc.
330 W. 42nd St., N. Y.

Send me Whittington's Industrial Inspection and Assembly for 10 days' examination on approval. In 10 days I will send $1.75 plus few cents postage or return book postpaid. (Postage paid on cash orders.)

Name .....

Address .....

City and State .....

Position .....

Company ..... A. 1-7-43

FOR VICTORY TODAY AND SOUND BUSINESS TOMORROW

Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow,* keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

If your firm has not already installed the Pay-roll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

EVERYBODY EVERY PAYDAY AT LEAST 10%

Save With

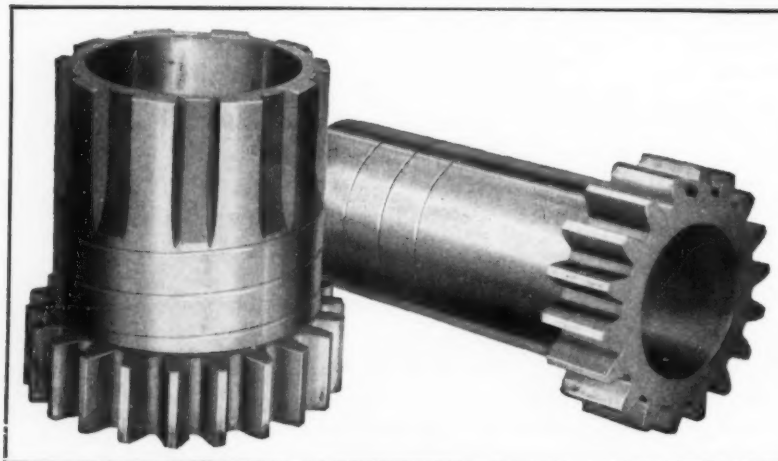
War Savings Bonds

This Space Is a Contribution to America's All-Out War Program by

AMERICAN MACHINIST

The gears produced in the modern Sier-Bath plant are made to stand the gaff of war time service which means absolutely uninterrupted performance. No peace time specifications can be more rigid than those imposed today.

SIER-BATH GEAR CO.
NORTH BERGEN NEW JERSEY
Incorporated

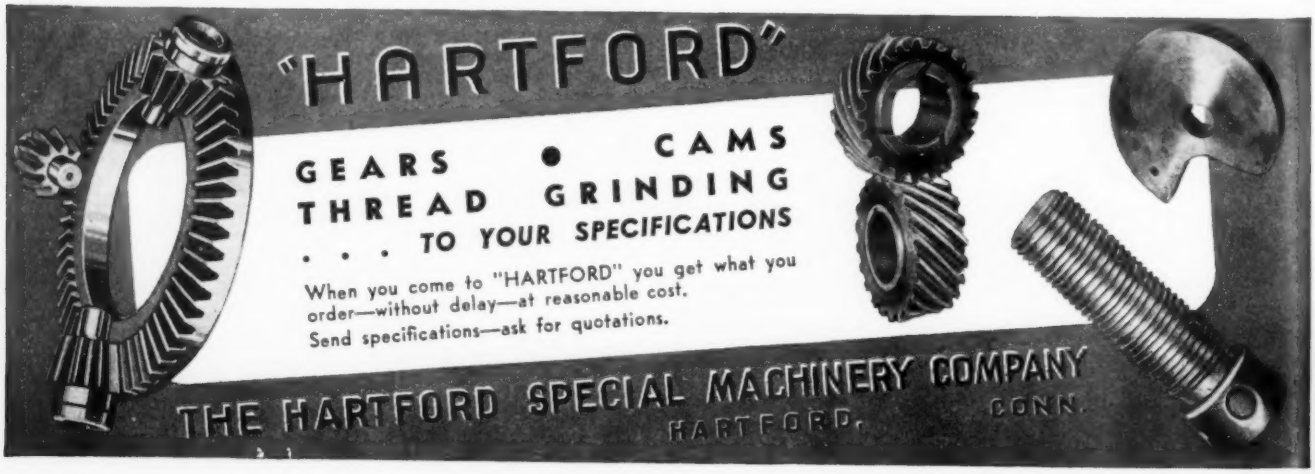


ADAMS GEARS

SPUR — HELICAL — WORM
BEVEL — MITER — RACKS

Splined Shafts A Specialty

THE ADAMS COMPANY
Est. 1883
1942 Bridge St. Dubuque, Iowa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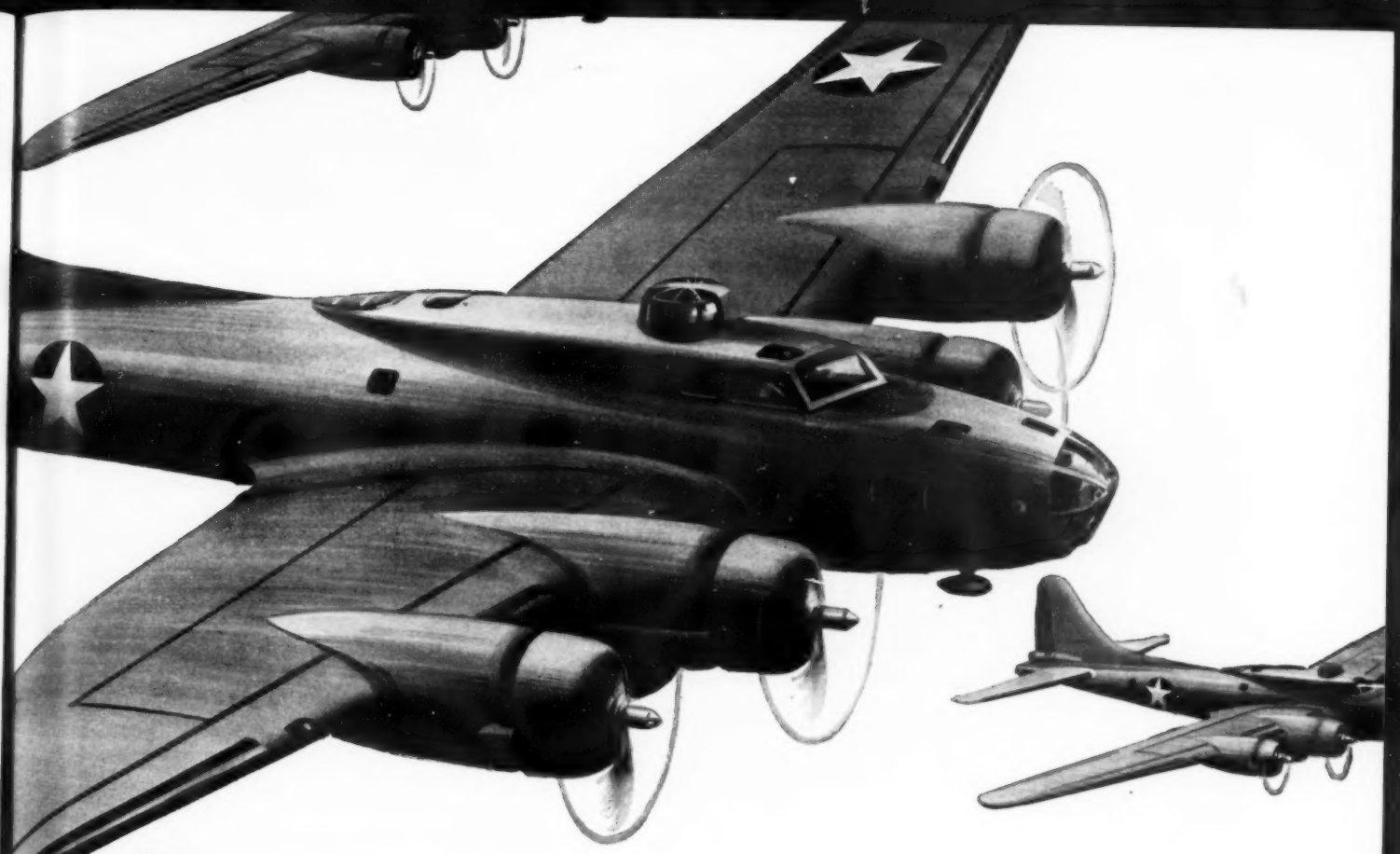
GEARS • CAMS
THREAD GRINDING
. . . TO YOUR SPECIFICATIONS
When you come to "HARTFORD" you get what you order—without delay—at reasonable cost.
Send specifications—ask for quotations.
THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD, CONN.



An Answer from the skies

"NO FOREIGN power can ever harm Germany from the air" was the boast of Hitler's air marshal. Yet today American planes, piloted by American airmen, are flying far into middle Europe, carrying loads of destruction to the mighty industrial plants—the huge utility system—the network of transportation lines that are all so vital to the Third Reich's military power.

This sky-borne answer to Goering's boast is dramatic proof of the quality of American planes—and the American engines that power them.

For as the size of these planes and the size of the loads they must carry have gone up—and up—and up—the engines that power them have kept pace. Today, motors of 2000 h.p. and over are an accepted fact with engineers looking forward to greater and greater horsepower in the motors of tomorrow.

What this increased horsepower means to the gears that transmit engine revolutions to the whirling propellers can well be imagined.

For aircraft gears must be light in weight, yet the slightest inaccuracy in gears revolving at such high speeds transmitting such great horsepower would quickly spell failure. No wonder aircraft engineers long considered such high precision gears a laboratory product.

But an air armada of the magnitude we are launching demanded that gears be produced by the hundreds of thousands.

That this problem was successfully solved is evidenced by the gears—thousands upon thousands of them—being daily turned out by the Precision Gear Plant of Foote Bros.—gears produced on a schedule that spells doom for the Axis ambition of world conquest.

And when the war is won, these new techniques and new methods that have made extreme precision in mass production possible promise a new era in the design of high speed machines for a peacetime America.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois

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Better Power Transmission Through Better Gears

PRECISION GEARS

AS SMALL AS
5/16"
ARE BEING
PRODUCED BY
DETROIT
BEVEL GEAR

★

Gears of all types are manufactured exactly to your specifications in sizes up to 16".

Supplied in any desired Material

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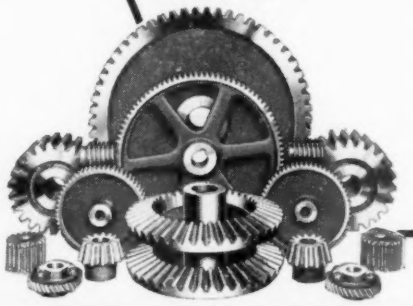
Makers of Quality Gears for 30 Years

CINCINNATI GEARS CAN *Take It...!*

That's why more and more vital war plants are ordering Cincinnati Gears for their important jobs.

That's why we are busy working exclusively on "Gears . . . Good Gears Only".



- *SPUR*
- *BEVEL*
- *HELICAL*
- *SPLINE*
- *WORM*
- *SPECIAL*

THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
1825 Reading Road • Cincinnati, Ohio

THE JOHNSON FRICTION CLUTCH

DOUBLE TYPE

IMPROVE POWER TRANSMISSION *with the* NEW "MAXITORQ" (MULTIPLE DISC) CLUTCH

This new JOHNSON design—the result of more than 40 years specialization in the development of friction clutches—is particularly adapted to machine tool application because of its compactness, simple adjustment and easily controlled engagement. It can be assembled or disassembled without the use of tools. Floating plates minimize drag, abrasion or heating in neutral.

"MAXITORQ" FLOATING PLATE MULTIPLE DISC CLUTCHES are available in dry (self lubricated) and wet (running in oil) types in single, double and cut-off coupling types. Capacities range from ½ HP to 5 HP at 100 r.p.m. Send for detailed dimension sheets.

WRITE FOR MULTI DISC CLUTCH CATALOG NO. 11

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

QUALITY GEARS CUT TO ORDER

• MEISEL produces but one *kind* of gears . . . gears constructed for specific jobs. Only through the inherent accuracy of this special designing could such dependability, performance and economy be possible. Tell us what you expect it to do, and we'll show you the *one* gear suited for your job.

MEISEL PRESS MFG. CO.
946 Dorchester Avenue Boston, Mass.

GANSCHOW GEARS

FOR SIXTY YEARS

Spur—SPEED REDUCERS—Worm

ALL TYPES OF CUT GEARS

GANSCHOW GEAR CO., 18 N. Morgan St., Chicago

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ECONOMICAL SERVICE
ALL TYPES, MATERIALS
AND QUANTITIES
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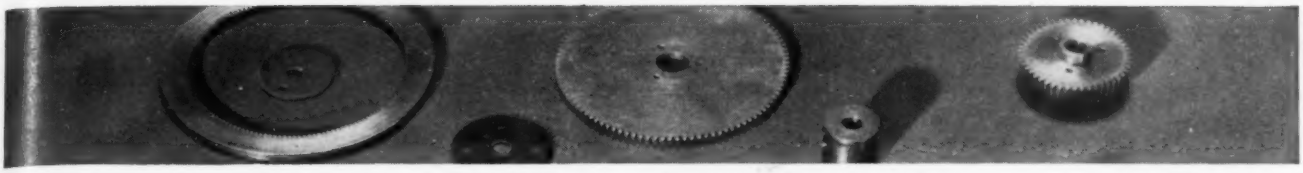
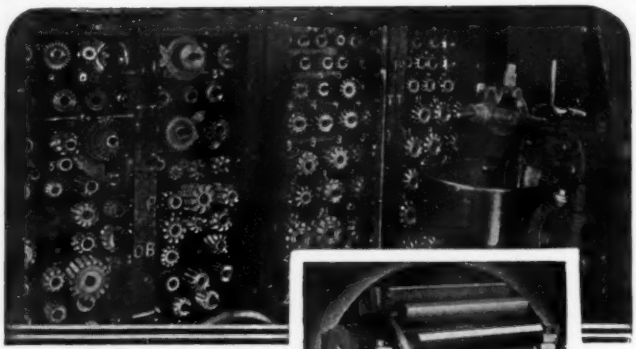
BRAUN GEAR CO., 1590-1608 Atlantic Ave., Brooklyn, N. Y.



Quaker City Gears Are Rolling with the Armed Forces on All Fronts

QUAKER CITY GEAR WORKS 1910-32 N. FRONT ST. PHILADELPHIA, PA.



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NO matter what your gear problems may be — no matter how large or how small your requirements—Stahl experience, workmanship, and manufacturing facilities can give you precisely the results you want at lowest ultimate cost.

Send us your blueprints and specifications today.

No charge or obligation for estimates and engineering cooperation.

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SPURS • HELICALS • BEVELS

(Straight & Spiral)

WORM GEARING • THREAD GRINDING

(14 to 96 D. P.)

This range logically embraces the gear components of many critical control devices essential to the war effort and this organization is proud of its contributions of such material in the program.

With full *production capacity* scheduled far into the future, all new inquiries are now necessarily subordinated to these vitally important prior commitments. However, every *urgent* need will be given careful consideration.

Gear Specialties

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Mac-its are heat treated to multiply the strength of every ounce of steel used in them. Designs that take advantage of these stronger screws save man-hours, machine-hours and metals.

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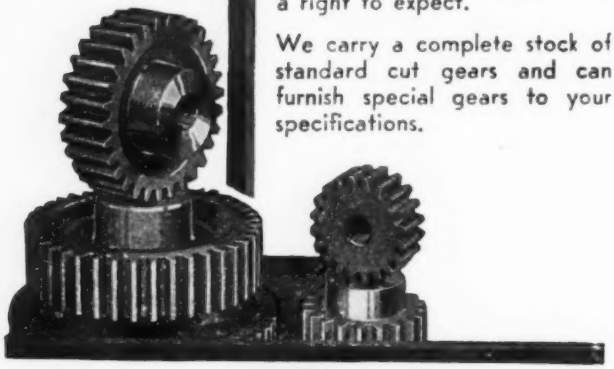
GRANT GEARS

"64 YEARS" MANUFACTURING GEARS

Despite the continued growth of our gear business we are still in position to give each customer the attention they have a right to expect.

We carry a complete stock of standard cut gears and can furnish special gears to your specifications.



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ESTABLISHED 1877 · GEAR · BY GEO. B. GRANT

ALL TYPES
ALL MATERIALS

BILGRAM BEVEL GEARS

Straight — Spiral Teeth

BILGRAM

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GEAR CUTTING MACHINES

New Design
New Features
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NEWARK GEAR CUTTING MACHINE CO.
69 Prospect Street, NEWARK, NEW JERSEY

Here Is *Why* the Belts *You* Use Should be Built with the

CONCAVE SIDE!

A very simple test (pictured above) will show you the great importance of the Concave side. To make this test, take *any* V-Belt and bend it as it bends in going around its pulley. With your fingers, grip the sides of the bending belt. You will feel those sides *change shape*. Fig. 1, (on the right) shows what this shape-change does to a *straight-sided* V-Belt. Note the out-bulge of the sides.

Now look at Figure 2. There you see how *differently* the same shape-change affects a V-Belt built with the patented Concave side. The Concave side merely becomes straight—and this makes the bending belt exactly fit its sheave groove. There is no side-bulge. This means that wear is distributed *evenly* over the *whole side* of the belt—insuring longer life! Also, the whole side of the belt uniformly grips the sheave wall. This means heavier loads are carried without slippage—a real saving in belts—which conserves one of the nation's vital resources—rubber!

Only belts built by Gates are built with the Concave side, a Gates patent.

What Happens When a V-Belt Bends

FIG. 1

FIG. 2

431

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Engineering Offices and Stocks in All Large Industrial Centers

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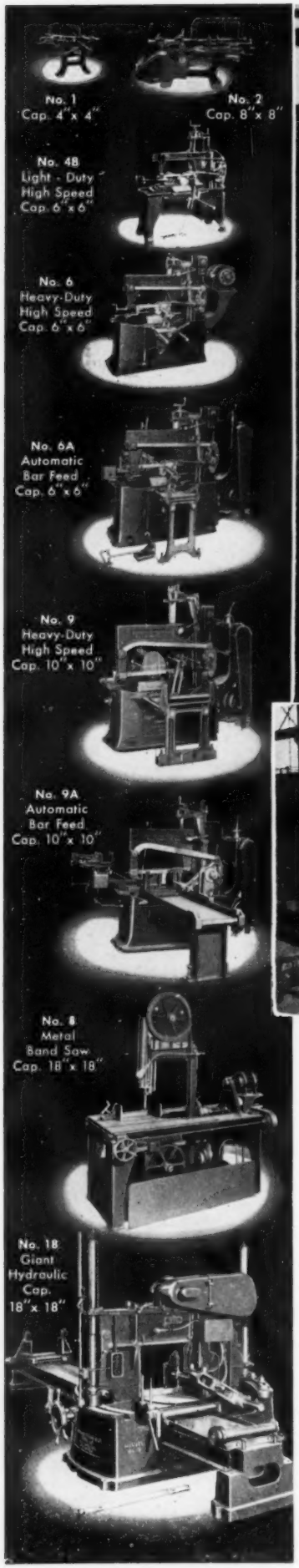

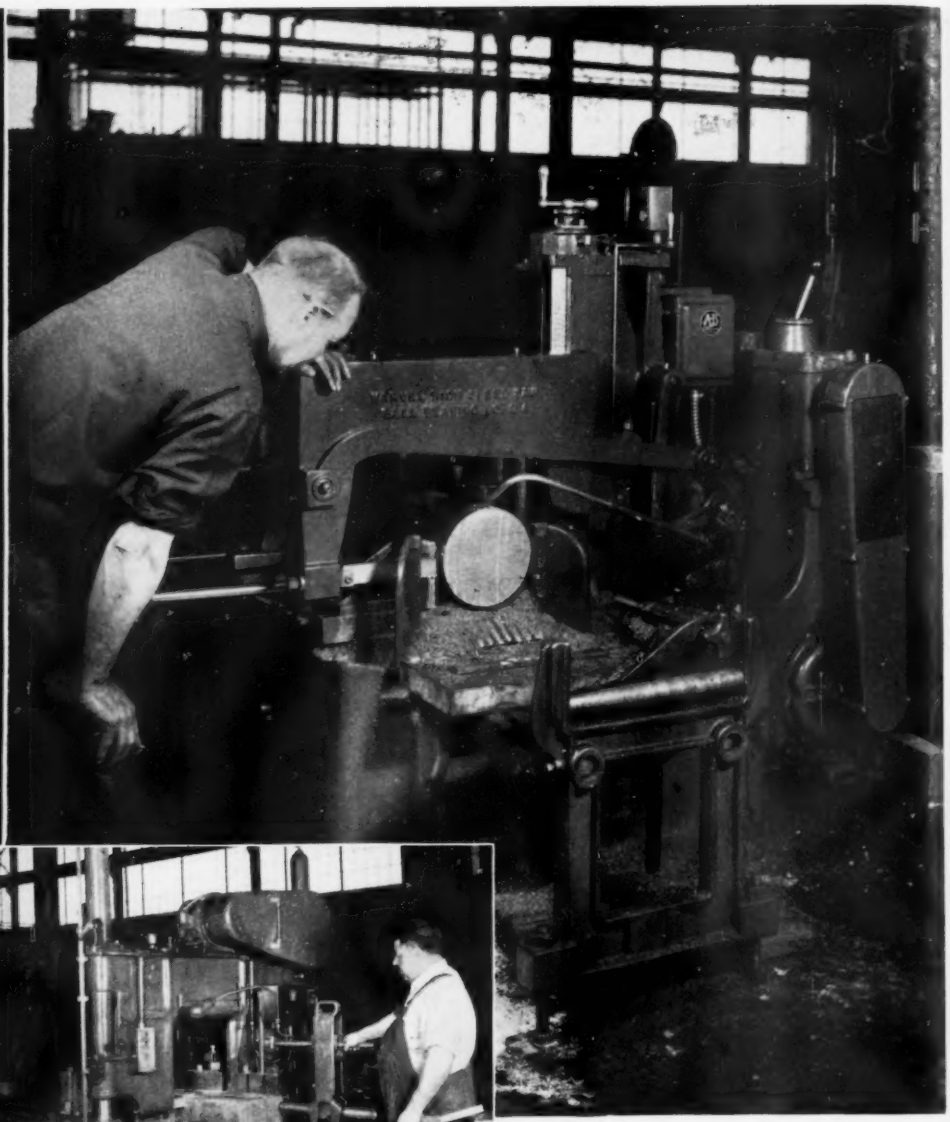

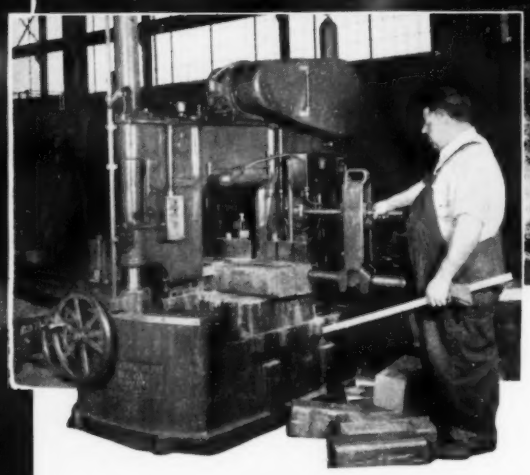

Above. MARVEL 9A Automatic Production Saw

Left. MARVEL No. 18 Giant Hydraulic Hack Saw

MARVEL'S years of pioneering has given America the World's fastest and most productive hack saws . . . has created a new high speed method of automatically cutting-off bars (MARVEL 6A and 9A Production Saws) . . . has made it possible to cut-off the largest sizes and toughest steels easily and quickly (MARVEL No. 18 "Giant" Hydraulic Saw) . . . has sped-up America's production of rifles, machine guns, mortars, artillery, aircraft, tanks—of war materials of all sorts.

ARMSTRONG-BLUM MFG. CO

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago, U.S.A.

Eastern Sales: 225 Lafayette St., New York

MARVEL SAWS

New Significance *for an* Old Name

HOWARD has long been a dominant name in the nonferrous castings field. Howard castings have been widely used in many well known machines and equipments.

Today, the name Howard takes on a new significance. Three plants combined — an aluminum foundry, a bronze foundry and a magnesium foundry — provide the largest nonferrous jobbing facilities in the United States. Our new magnesium foundry has a capacity alone of over 500,000 pounds of castings per month.

Naturally, America's war industries have turned to this dependable source of nonferrous castings; and all three plants are supplying the needs of makers of planes, guns, tanks, ships, military vehicles and essential machines.

Today, Howard castings are available only to those with adequate priority ratings, but war uses of nonferrous castings are pointing the way to new and important peace-time applications, especially in the field of magnesium. Accordingly, Howard will be in a position to render a broader service to industry after the war.

Howard Foundry Company
4900 Bloomingdale Road Chicago

HOWARD

ALUMINUM · BRASS · BRONZE · MAGNESIUM

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Syracuse, New York

General Tool Sales Co.
3945 N. Broad Street
Philadelphia, Penn.

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William Yaegher, Jr.
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Hartford, Connecticut

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H. S. Kartsher
3411 Perkins Avenue
Cleveland, Ohio

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2900 Dixie Drive
Dayton, Ohio

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7430 Bruno Avenue
St. Louis, Missouri

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Machinists' Tool & Supply Co.
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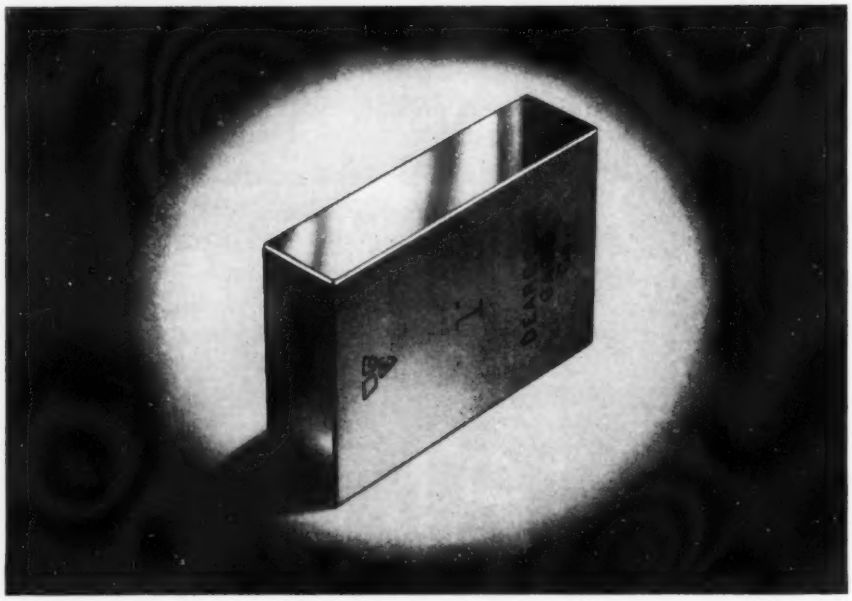
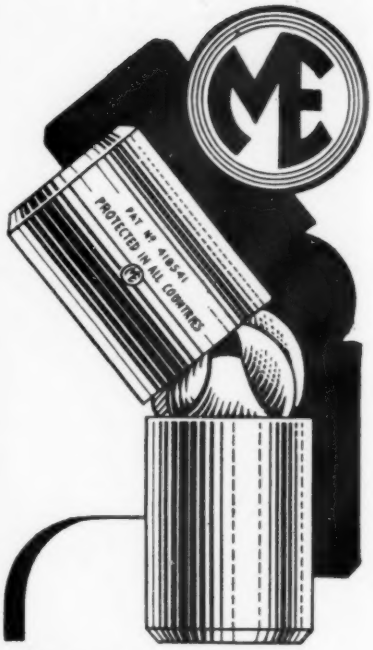
22035 BEECH STREET • DEARBORN, MICHIGAN
Originators of Chromium Plated Gage Blocks





Patent
UNIVERSAL BALL JOINTS

- Made in a range of 9 sizes for shaft diameters ¼" to 1⅜".
- Standard Joints have maximum angle of 38° from the straight line.
- Made by the largest manufacturers of UNIVERSAL JOINTS in Great Britain.
- Widely used in Machine Tools, accessory drives and on Aircraft.
- Certified 92% to 98% efficient by the British Government's National Physical Laboratory.

Catalogues on request.

The
MOLLART
Engineering Co., Ltd.

KINGSTON BY-PASS, SURBITON,
SURREY, ENGLAND.
Telegrams: PRECISION, SURBITON

FIGHTING TOOLS NOT FIGHTING TALK!

Ship worn-out High Speed Tools back to the steel mills – this high grade steel can do another war job.

If you want high production and accuracy from machine operators, give them high-grade cutting tools. Fighting tools – not fighting talk – produce results!

MORSE THERE IS A DIFFERENCE TWIST DRILL AND MACHINE COMPANY
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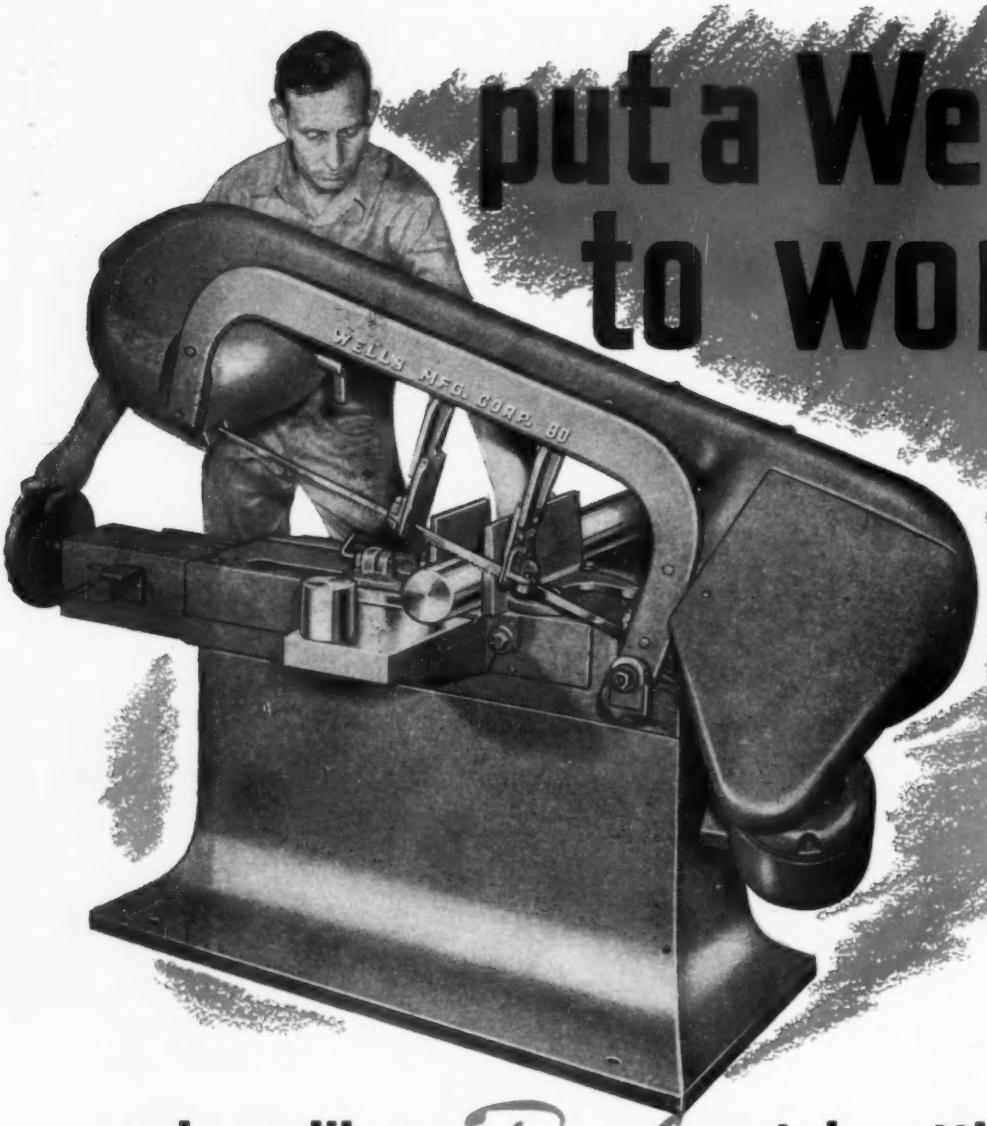
put a Wells to work...



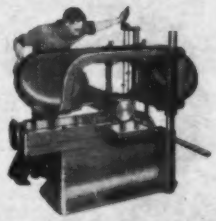
...and you'll see *Real* metal cutting action!

WHEN you want fast precision metal cutting in production, tool room or general maintenance work — put a Wells on the job. You'll have a saw that handles many shapes and types of metal with unusual smoothness and accuracy.

The Wells Series 80, above, is the latest model of the popular Wells No. 8. It has all the advantages that Wells have built into their products through years of leadership in band saw manufacture. It is a rugged, versatile unit, capable of cutting up to 8" rounds or 8" x 16" rectangles. You will find it one of the handiest tools in a plant. You can get one quickly too! Phone your distributor or write us.

Wells Has Established Leadership

WELLS V-12



Capacity is 13" rounds; 13" x 16" rectangles.

WELLS MANUFACTURING CORPORATION

Wells **METAL CUTTING BAND SAWS**

606 ADAMS STREET • THREE RIVERS, MICHIGAN

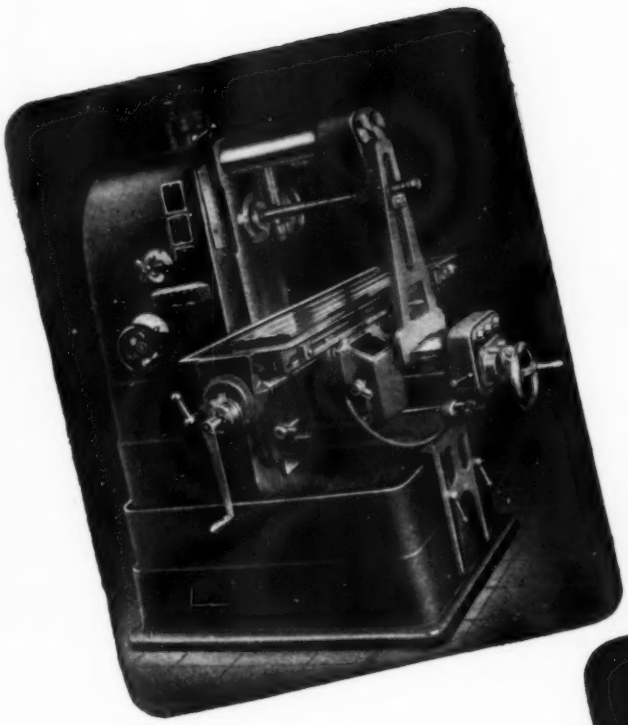
THE LOMBARD 2 in 1 MILLER

UNIVERSAL TYPE MILLER

For Either

HORIZONTAL OR VERTICAL WORK

Salient Features



CONSTRUCTED FOR PRODUCTION

Table is equipped with six direction power rapid traverse, longitudinal table travel has table dog controlled automatic cycle. These advantages, coupled with its large dimensional capacity and extreme ruggedness, makes it the ideal production machine.

UNIVERSAL SAFETY FEATURE

Safety interlock insures against injury by table cranks. Safety torque slip clutches prevent overloading on all power rapid traverse and power feed travels.

CONSTRUCTED FOR PRODUCTION

Column, base, knee and saddle of heavy section block construction. All castings heat treated to overcome casting and machining stress.

FOR HORIZONTAL WORK

Three bearing mounting of the large double overarms overcomes torsion and stress in the arbor support. Overarm brace ties arbor support to the knee, which is tied to the base, giving the cutting arbor more than usual rigidity, and does faster and finer work.

FOR VERTICAL WORK

Rugged head structure, hinge mounted, transforms horizontal into swivel head vertical machine. Vertical quill is hardened and fitted in a ground bore with pick-up screw and point. Spur drive and spindle gives high torque and high speed belts transmit full spindle horse power.

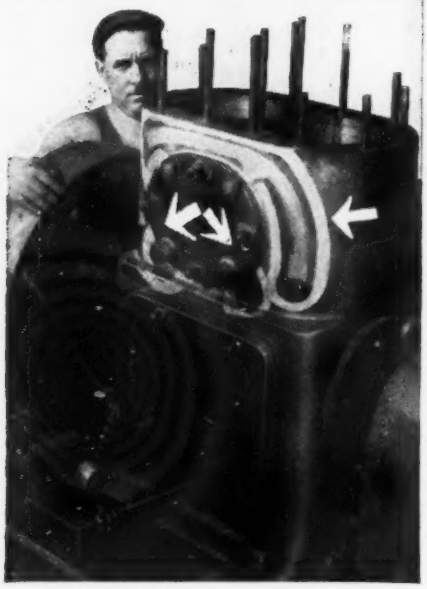
The Lombard 30 HV Milling Machine is sold both as a single purpose machine (horizontal or vertical) or as the Universal Machine.

Write for folder and prices.

LOMBARD GOVERNOR CORPORATION

ASHLAND, MASSACHUSETTS, U. S. A.

Castolin Eutectic
LOW TEMPERATURE WELDING



Large two cylinder air compressor with badly cracked water jacket. Salvaged with Castolin Eutectic Low Temperature Welding Alloy. No general preheating. Time 1½ hours.

SAVE TIME! SAVE MATERIALS!

RECLAIM DEFECTIVE IRON CASTINGS

WHY waste time and materials? Reclaim broken, cracked, worn or defective castings, easily, economically. Use Castolin Eutectic Alloy #14 (gas welding) and Castolin Eutectic Alloy #24B (AC-DC metallic arc). These new low temperature welding alloys assure you of a completely machinable, color matching, stress and distortion free weld every time.

Prominent manufacturers now use Castolin Eutectic Low Temperature Welding Alloys #14 & #24B in place of "hard to get" bronze welding rods. Castolin Eutectic Alloys #14 & #24B contain no scarce metals . . . available with priority A9.

Write for DATA BOOK M9

Contains complete information on Castolin Eutectic Low Temperature Welding Alloys for Welding Cast Iron, Iron, Nickel, Steel, Aluminum, Bronze, Copper, Brass, Magnesium, etc.

Tool Salvaging Poster for your Shop Free!

Some territories available for Manufacturers Representatives

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W TO SAVE ~~80%~~ 33⅓% OF YOUR NEW TOOL COST

Three New Advantages in Severance Regrinding Service

Beginning in January, 1943, the Severance Tool Company announces, (1) an additional saving of 33-1/3% to the customer for regrinding Midget Milling Cutters, (2) a special high speed tool hardening process, known as Severite, applied to tools after they have been reground. Severite hardens the teeth of a cutter increasing the life between regrinds from two to five times, and (3) 72-hour service—your renewed tools are shipped within three days of the time they are received at the Severance plants.

Write for complete facts about the new Severance regrinding process. And ask for the latest Severance "Toollog" showing the many types of new Midget Milling Cutters available.

A few of the many shapes of Severance Midget Milling Cutters.

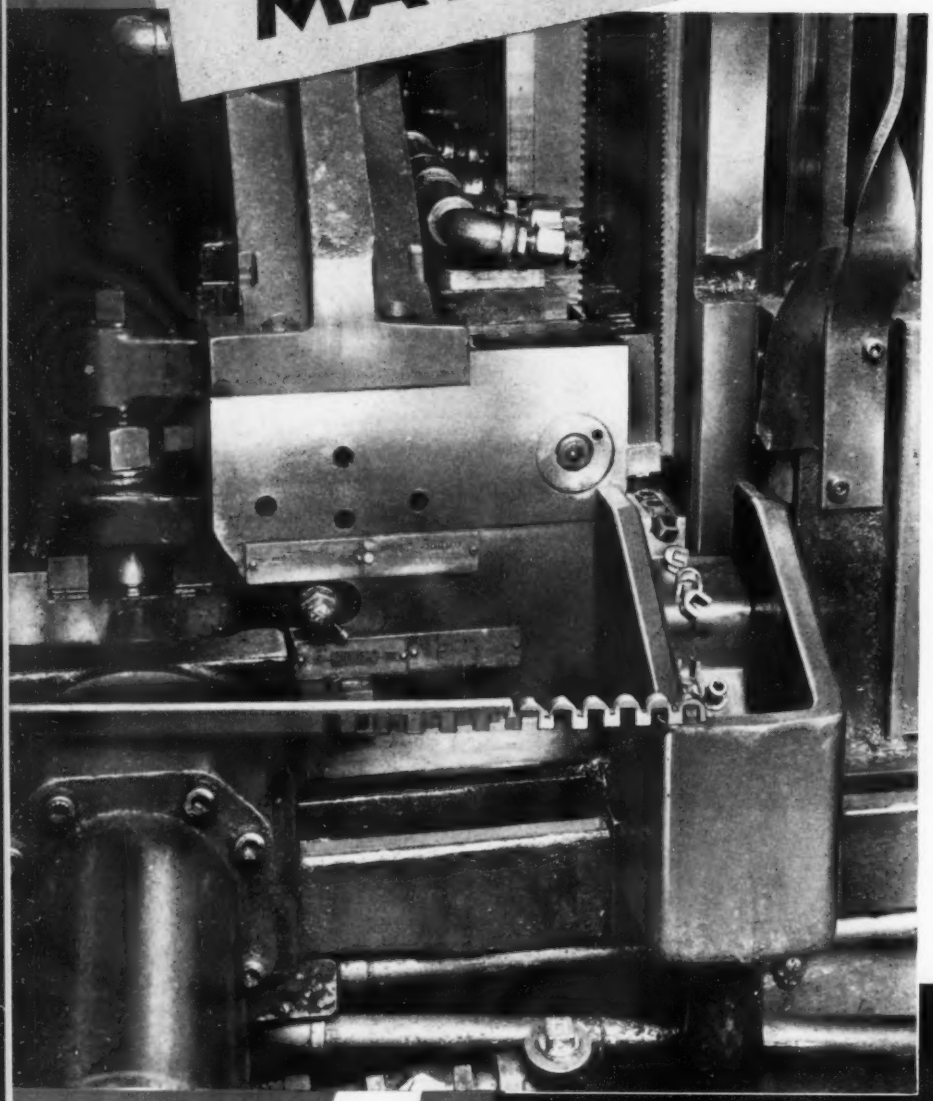
Severance

MIDGET MILLING CUTTERS AND PRECISION REGRINDING

SEVERANCE TOOL COMPANY, SAGINAW, MICHIGAN · BRANCH PLANTS:

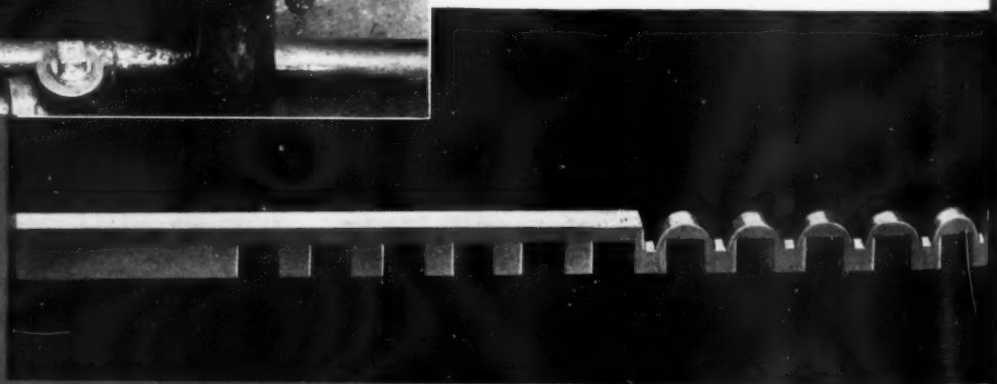
SAVING TIME LABOR MATERIALS

PRODUCTION —BY



At the Hamilton Standard Propeller Division of the United Aircraft Corporation, a Lapointe Broaching Machine is making possible a production short cut that not only saves time, but also reduces labor cost and saves vital materials! The job is producing large quantities of U-shaped spring pack retainers, 16 of which are required for pitch changing mechanism of each hydromatic propeller blade. Formerly milled and cut off from specially formed extruded bar stock, they are now being produced — and being produced faster — from a standard rectangular bar stock that is quickly available and much lower in cost.

A standard Lapointe Broaching Machine is used, equipped with an automatic feed and special index features that assure

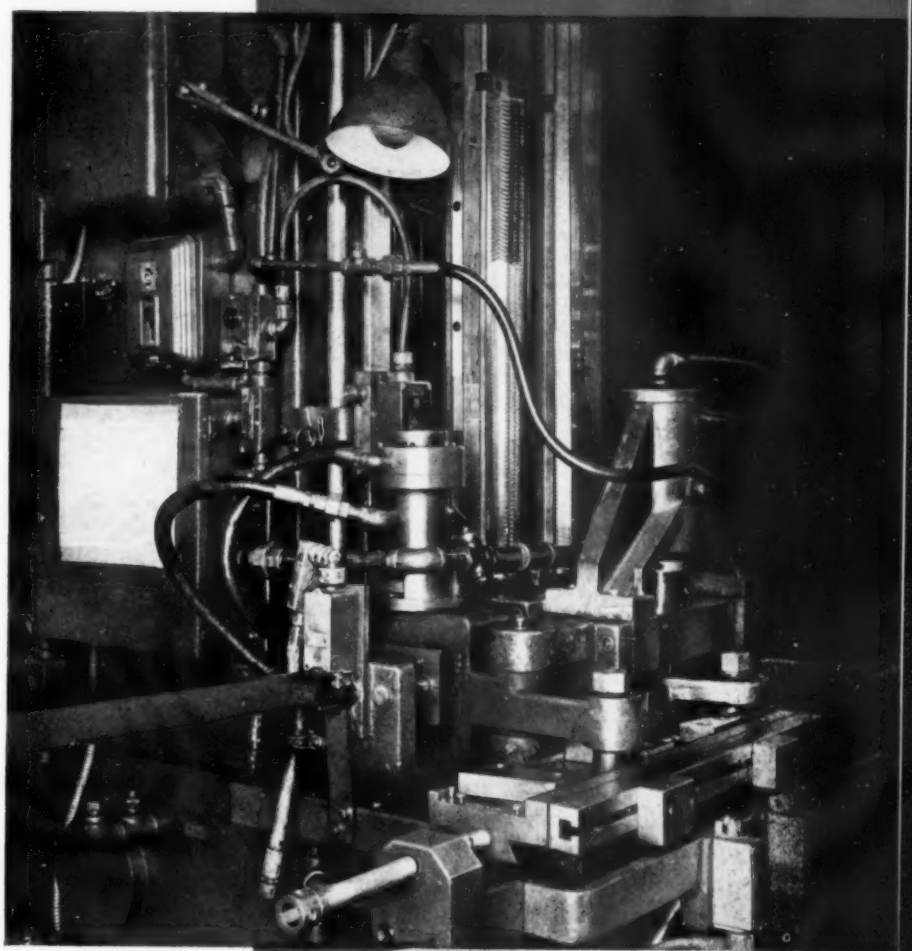


THE LAPOI

ING AIRCRAFT PARTS
THE THOUSANDS!

precision alignment. This feed mechanism can be seen in the photo at the right. As the sequence strip in the photo at left illustrates, three broaches first cut slots in each side of the stock; the next three broaches form the radii on the opposite side, and finally the pieces are parted, using three saw-type broaches. As all the operations are performed simultaneously, three complete parts are produced at each stroke of the machine. An analysis of the operation reveals that the cost per unit for these small but important propeller parts has been cut 75%.

This is an example of the type of cost-cutting and production improvement which Lapointe is contributing to the war production program — making a simple "one machine" job out of an operation that formerly required several machines and several skilled operators. Other Lapointe broaching machines and methods are speeding such precision jobs as gun rifling, breech block manufacture, marine turbine blade forming and many other important operations in the building of aircraft, ships and munitions. Send us details of a job on which you are looking for a production short cut, and get our engineering recommendations.



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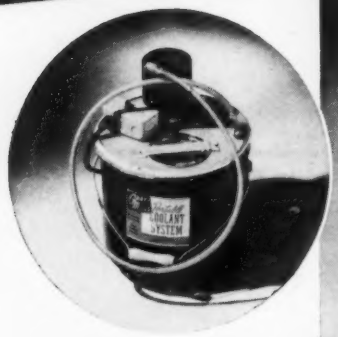

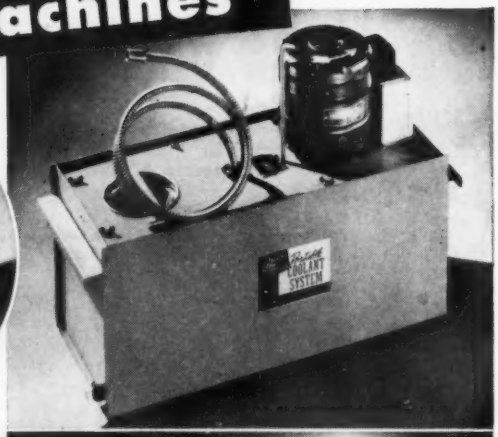

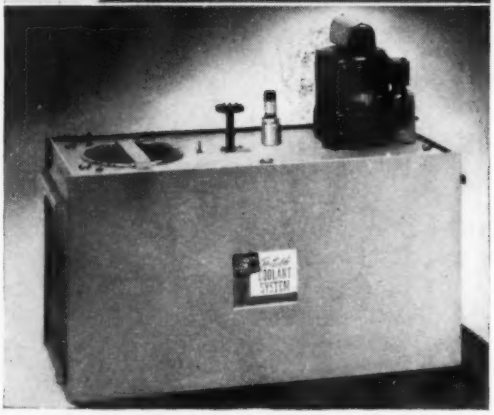

Above: Standard Model — capacities up to 130 gals. per hour. Above, right: Heavy Duty "A" Series Model — capacities up to 165 gals. per hour. Right: Model H-10A Centrifugal — capacities 10 to 1,000 gals. per hour.

•

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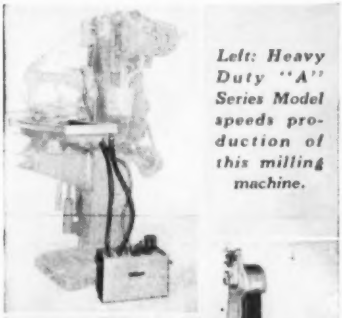

Left: Heavy Duty "A" Series Model speeds production of this milling machine.

Right: Heavy Duty "A" Series Model provides controlled coolant flow to this belt grinder.

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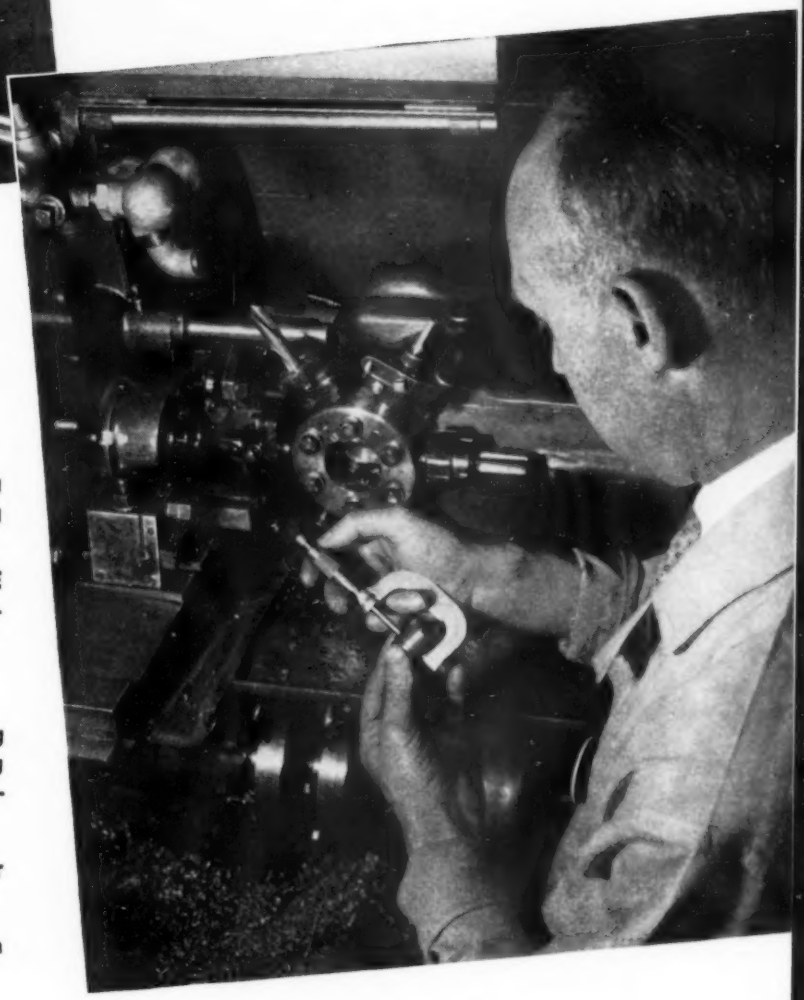

The following suggestions will help save many a micrometer — make others last longer and serve better:

DO NOT measure revolving work.

DO NOT JAM the work against the anvil by forcibly turning the spindle. This may spring the frame or force the measuring surfaces out of line.

Unless micrometers have special measuring surfaces, **USE EXTREME CARE** in measuring over cutting edges, such as reamers and drills.

DON'T OPEN a micrometer by twirling it.

DO NOT LOCK the Micrometer Caliper at a particular setting and use it for long periods as a caliper gage. The measuring surfaces are too small in area to permit such use for a considerable length of time without excessive wear.

In the grinding room, **AVOID EXPOSING** your Micrometer Caliper to a flood of coolant containing grit or emery.

DO NOT CARRY your Micrometer Caliper in a pocket in which there may be dirt or grit. Keep it in its box when not in use.

KEEP the measuring surfaces apart when putting the tool away. If left together, moisture on them can cause rusting.

FOLLOW lubricating and adjusting instructions issued by the manufacturer.

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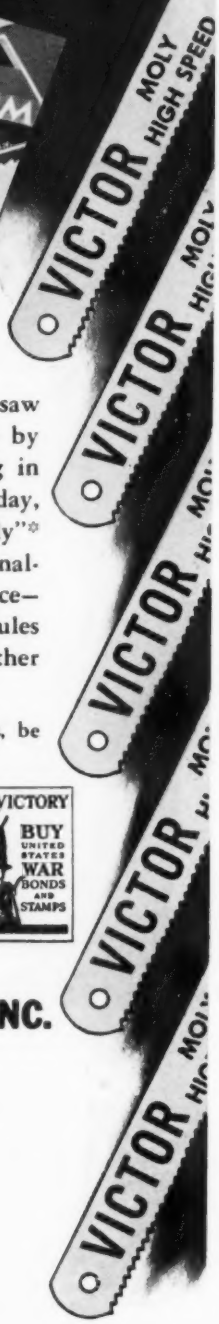

The first molybdenum alloy hack saw blade, pioneered ten years ago by VICTOR, gave you a 50% saving in heavy duty metal sawing costs. Today, with tungsten scarce, VICTOR "Moly"* High Speed—still ahead in steel analysis, heat treatment and performance—is maintaining production schedules for plants who have been using other types of high speed blades.

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3381

What causes poor threads?

H&G CHECK CHART

A GUIDE TO BETTER SCREW THREADS

Under war conditions, it becomes more and more important that we get the most we can out of the tools and materials that we work with.

Reducing the amount of scrap is the same as increasing the quantity of tools and materials available for war work.

If you are cutting screw threads, you will find the "Check" list shown below, a valuable guide towards better efficiency. If you are having any difficulties, find them in the following list and check the causes mentioned.

SO CALLED TAPER THREADS
Poor alignment.
Poor start.
Drag due to machine conditions.
Bad camming.
Chasers shave*
Loose front plates or
Dirt under front plates.
Dirt in chaser slot of carriers, throwing chasers out of trackage or off on length, causing shaving condition.
Worn locking mechanism.
Bent Die Head shanks.
Die Head needs overhauling.
Chasers or carriers sloppy fit in Die Head.

OFF LEAD
Chasers cut hard, due to improper chamfer relief.
Chasers are forced.
Chasers are held back by drag.
Chasers shave.*

ROUGH THREADS
Material cuts poorly.
Dull chasers.
Poor grinding.
Improper cutting fluid.
Too high speed.

POOR THREADS AT START
Poor grinding.
Hesitating start or
Poor camming
Poor alignment.

THREADS DO NOT FIT GAGES
Threads off lead.
Threads taper.
Poor thread form.
Improper setting of the gage itself or worn gage.

POOR MACHINE CONDITIONS
Non-alignment.
Poor condition of spindle.
Cramping action.
Improper camming.
Too much load.
Improper speed.
Improper flow of cutting lubricant.

CHASER BREAKAGE
Chasers hit shoulder.
Worn chasers.
Dull chasers.
Improper grinding.
Back drag in machine.
Chip Shavings in Die Heads.
Chasers or carriers sloppy fit in Die Head.
Poor alignment.
Poor start.
Poor condition of threading spindle.
Improper cutting fluid.
Soft stock builds up false cutting edge.
Too small a die head for job.
Chasers not properly adjusted to size when starting.
Oversize stock, causing chasers to mill too much from O.D. or to start hard.

Look thru past issues of "Die Headlines" where these subjects are dealt with. Write for any copies you may have missed and for any of the instruction books shown on the last page.

*To determine this, stop machine while cutting before die head opens and determine which chaser is shaving. Remove keenness of frosted edges on teeth back of chamfer using a knife edge or very fine hone.

Free—

To users of H & G DIE HEADS

THE Check Chart illustrated above will be mailed upon request together with the current copy of "DIE HEADLINES" an informative publication issued from time to time and dealing with practical suggestions for cutting more and better screw threads. This is a part of the service given to users of H & G Die Heads. Please state the makes of screw machines and the style and sizes H & G Die Heads used.

H&G DIE HEADS

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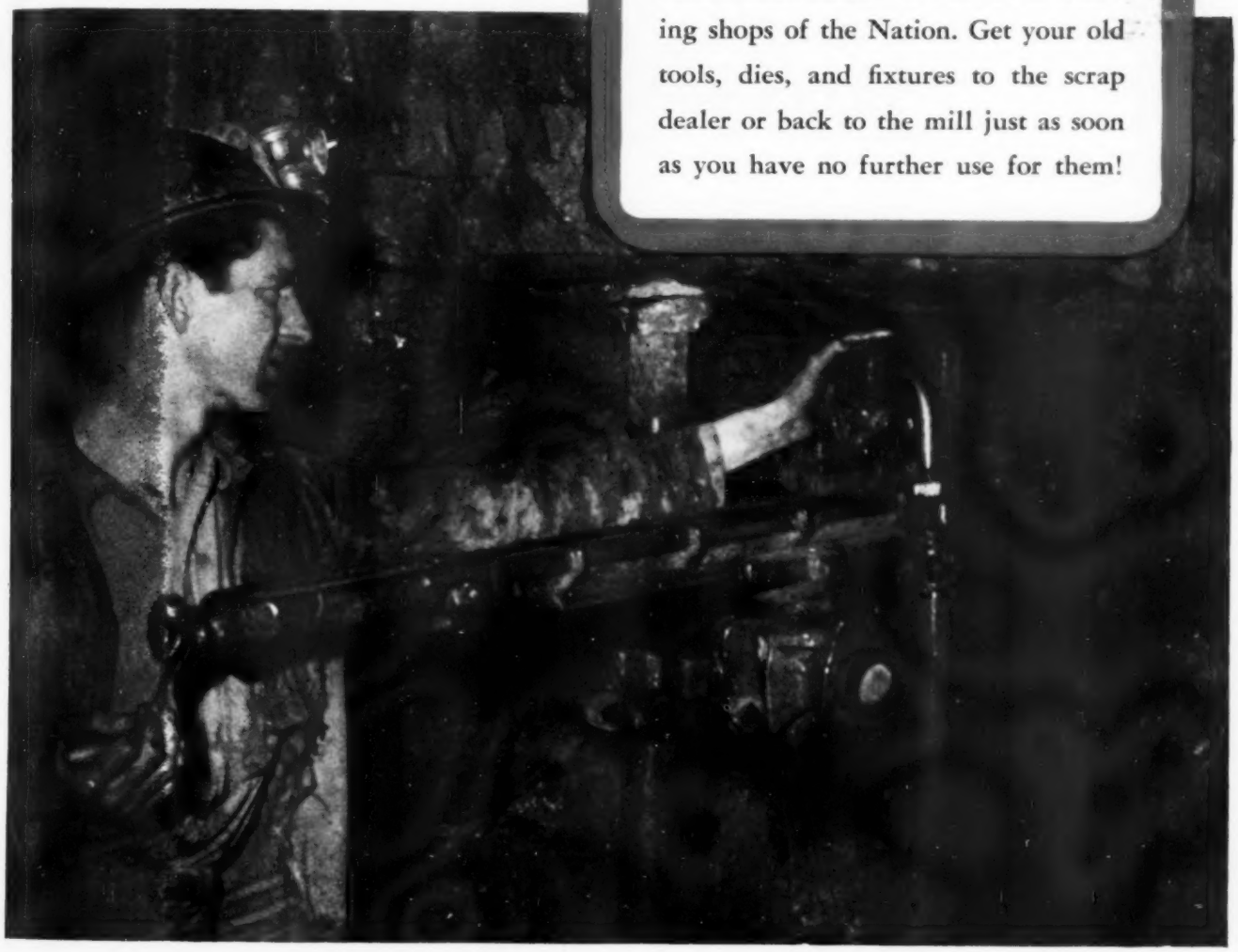

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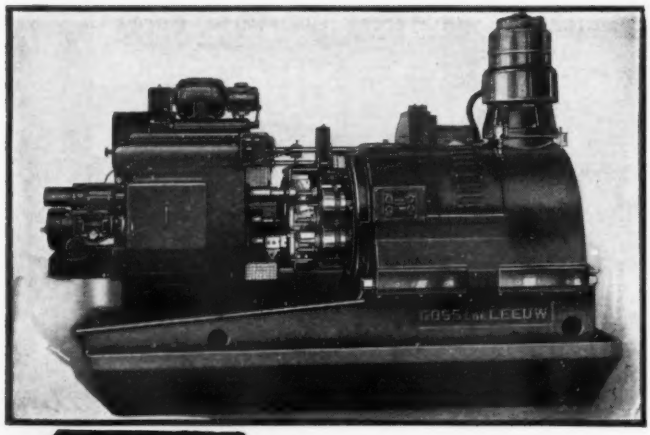

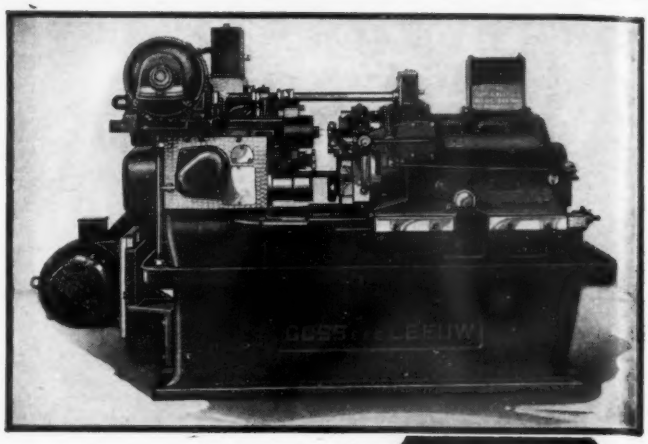

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5 Spindles
6 Spindles
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Features include:

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TOOL ROTATING TYPE
4 Spindles
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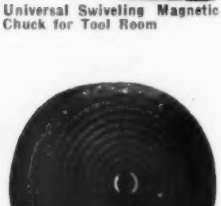
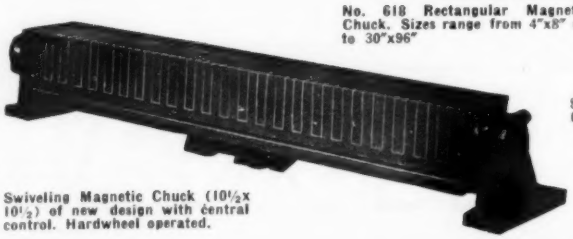


Style D Face Plate. "Concentric Gap" Type



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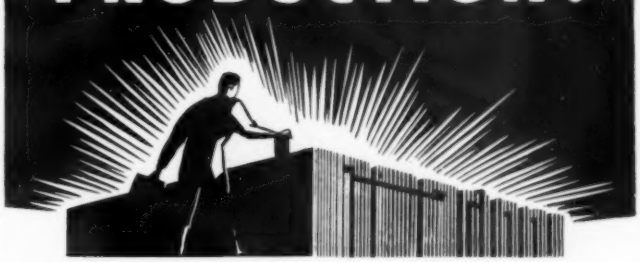

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You can get more output from the same number of operators by utilizing low-cost DELTA Power-Feed Drill Presses. They permit operators to perform additional jobs while the power-feed works automatically and quickly pay for themselves. And here's important news: These new Delta Power-Feed Drill Presses are priced considerably lower than the customary price ranges for drill presses of this quality.

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The unusual design of the Delta Power-Feed unit, which operates directly off the bottom drive of the motor instead of off the spindle, makes possible a wide range of feeds, from .0010 to .016 inches per revolution of spindle in the Slow-speed drill presses and from .0005 to .009 in the High-speed machines. Other special features include: 1. Quick traverse by hand from starting position to work; 2. Instant switching from power to hand feed and reverse without changing or removing parts; 3. Safety lock for preventing damage to drill press when power feed is disengaged; 4. Adjustable automatic stop and return.

This new line includes single and multiple spindle 17" units, in slow speed and high speed models, with table raising or head raising mechanisms, powered with either Delta or standard NEMA frame motors.

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Ask your nearest Delta Industrial Distributor for specifications and prices on the new line of Delta 17-inch Power-Feed Drill Presses or write direct to us.

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THE DELTA MANUFACTURING CO.
608-A Vienna Ave., Milwaukee, Wis.
Please send me Special Bulletin on the new line of Delta 17-inch Power-Feed Drill Presses.

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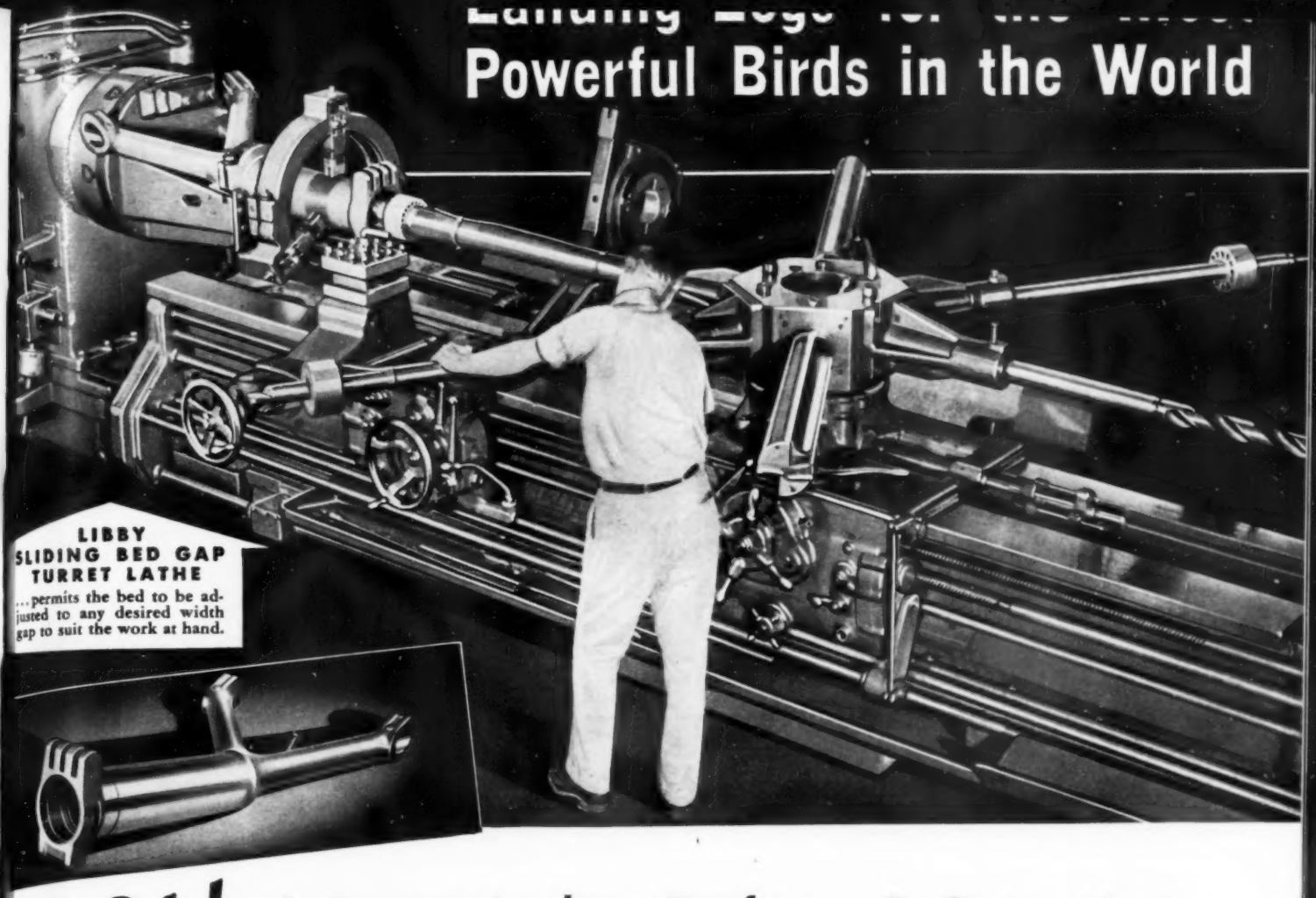
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LIBBY
SLIDING BED GAP
TURRET LATHE
...permits the bed to be adjusted to any desired width gap to suit the work at hand.

Libby Turret Lathes Perform 9 Operations on Airplane Landing Struts

Drilling a $6\frac{1}{4}''$ diameter hole, $34\frac{1}{2}''$ deep, from solid forged steel is the first operation performed on this Libby Heavy Duty Sliding Bed Gap Turret Lathe. Subsequent operations include additional drilling, boring, forming, reaming and threading operations.

Due to the design of the landing leg, it is necessary to use a special cradle-type fixture mounted to the face of the chuck. Further provision is made for handling this oddly shaped part through the bed gap design of this Libby Heavy Duty 4H Turret Lathe. The Sliding Bed Gap Turret Lathe is a Libby innovation. This particular machine is provided with a gap to swing 84″ diameter and the width of the gap may be adjusted from 0″ to 44″. Fixed bed gap machines can also be furnished.

This is another example of International service in unusual turret lathe work. Perhaps our engineers can help you on similar work. They are available for consultation without obligation.

The Job in Brief

Part—Airplane Main Leg Landing Strut.
Material—3140 Forged Steel.
Holding Method — Special Fixture Mounted on Chuck Face.

OPERATIONS:

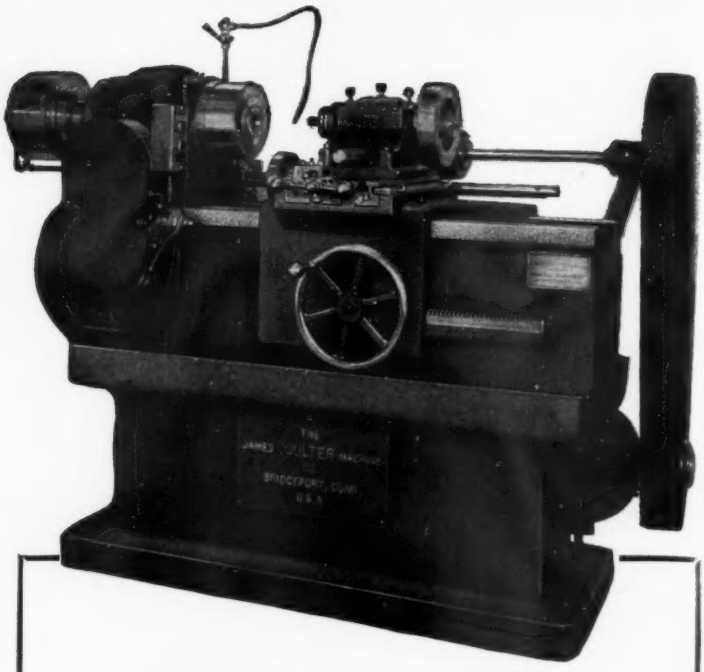
1st—*Drill* $6\frac{1}{4}''$ *Dia. Hole*... $34\frac{1}{2}''$ deep from solid.
2nd—Drill $2\frac{7}{8}''$ dia., 1″ deep in bottom of $6\frac{1}{4}''$ hole.
3rd—Form $5\frac{13}{16}''$ dia., $3\frac{1}{2}''$ deep, blending $\frac{3}{8}''$ radius to $\frac{3}{4}''$ radius.
4th—Bore 6.875″ hole with piloted bar.
5th—Drill and ream $\frac{7}{8}''$ hole in bottom of 6.875″ hole... 42″ from front end of strut. Tolerance on this operation .001″.
6th—Face with cross slide.

The piece is then heat treated and additional operations performed on Libby Heavy Duty Turret Lathe.

FREE booklet contains additional information concerning other valuable features of the Libby Heavy Duty Turret Lathes...write for your copy today. Write to the Libby Division, 1126 W. 21st Street, Indianapolis, Indiana.

INTERNATIONAL MACHINE TOOL CORPORATION
LIBBY DIVISION, INDIANAPOLIS, INDIANA • FOSTER DIVISION, ELKHART, INDIANA
MAIN OFFICE AT ELKHART, INDIANA
FOSTER EASTERMATICS • LIBBY HEAVY DUTY TURRET LATHES • STANDARD TOOLS

Keep Ahead of DEFENSE DEMANDS on the PRODUCTION of EXTERNAL and INTERNAL THREADS



The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

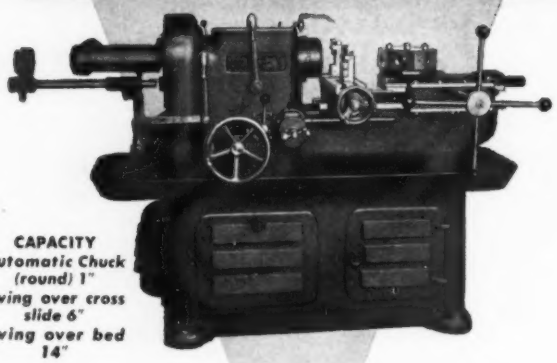
Maximum external thread, 7"; minimum hole depends on smallest hob practical.

Send for Descriptive Bulletin giving full information.

The James COULTER Machine Co.
BRIDGEPORT • CONNECTICUT • U.S.A.

for ECONOMY—for HIGH SPEED PRODUCTION

The MOREY 2G
Back-Geared
TURRET LATHE
Timken Bearing
Self-Locking Turret and Infinite Spindle Speeds



CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 629 for full details

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

TUTHILL

THE COOLANT PUMP that laughs at chips and grit

There are good reasons why the Tuthill Model M Coolant Pump is outstanding in wartime production. Compactly built, this positive displacement internal-gear rotary pump is designed with an exclusive safety feature that assures long, dependable, uninterrupted service.

Model M has a built-in, automatic by-pass which permits small chips and similar particles to pass through the pump without serious injury to working parts, and compensates for wear.

Six sizes from 1 to 50 g.p.m. Available in stripped form for direct incorporation into the design of the machine, to save space and material.

Write for complete catalog describing these and other dependable pumps for production machinery and scores of wartime applications

Tuthill PUMP COMPANY
939 East 95th Street • Chicago, Illinois

Here's a machine that helps to relieve

MANPOWER SHORTAGE

SIMPLIFIED DESIGN of this modern, motor driven lathe eliminates many costly features not required for a wide variety of turret lathe work.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Now Equipped with Automatic Indexing Turret

Concentrate highly skilled operators on complicated machines to handle only such jobs as demand top skill. Divert a wide variety of simpler operations to the Oster No. 601 "RAPIDUCTION" Turret Lathe which does the work equally well but with less experienced operators.

That formula, simple as it sounds, has proved to be an effective solution to the growing problem of "MAN POWER SHORTAGE" of highly skilled workers who can't be "duplicated" with novices crammed with a few weeks training.

But the same "novices" CAN be brought quickly to high standards of efficiency with the Oster No. 601 "RAPIDUCTION" Lathe. This modern, motor driven machine with its six-position turret now controlled by automatic indexing is doing multiple-shift work in scores of war production plants.

We're celebrating our 50th Anniversary by helping war production plants minimize the problem of MANPOWER SHORTAGE.

The form below is a convenient way of inviting us to "celebrate" in YOUR plant.

No Time Out to Celebrate Our 50th ANNIVERSARY 1893-1943

OSTER

THE OSTER MFG. CO., 2049 E. 61st ST., CLEVELAND, OHIO, U. S. A.

★ O.K. Oster. We're interested in the No. 601 machine. ( ) Send Catalog No. 601. ( ) Ask your nearest distributor to see us at once. (Check either or both of above requests.)

NAME.....

ADDRESS.....

CITY..... STATE.....

WILLARD *Spring* TOOL HOLDERS

SAVE TIME • PROTECT WORK • INCREASE CUTTER LIFE

These modern tool holders—especially adapted for use in precision production—can be depended on to prevent chatter and protect against broken cutters and damaged work.

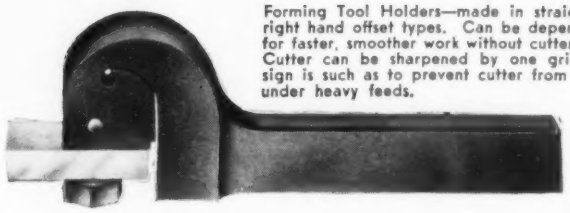
Willard Tool Holders offer a spring feature which makes it safely possible to step up feeds and make heavier cuts, thereby saving valuable time on important war production work.

•

WILLARDS ARE AVAILABLE FOR FORMING TOOLS, CUTTING-OFF TOOLS THREADING AND FORMING TOOLS, AND THREADING TOOLS—

Threading and Forming Tool Holders—a universal holder for use on fine or coarse threading. Eliminate possibility of chatter or tool marks—assure uniform high quality work and more pieces per grind when used for holding forming tools.

Forming Tool Holders—made in straight and right hand offset types. Can be depended on for faster, smoother work without cutter marks. Cutter can be sharpened by one grind. Design is such as to prevent cutter from turning under heavy feeds.



Threading Tool Holders—made in straight and right hand offset types. Assure smooth, accurate threads right up close to shoulder. No fitting to gauge when grinding—no adjustment in tool post after grinding.

PROMPT SHIPMENTS ASSURED *Write today for Folder giving details of sizes and types.*

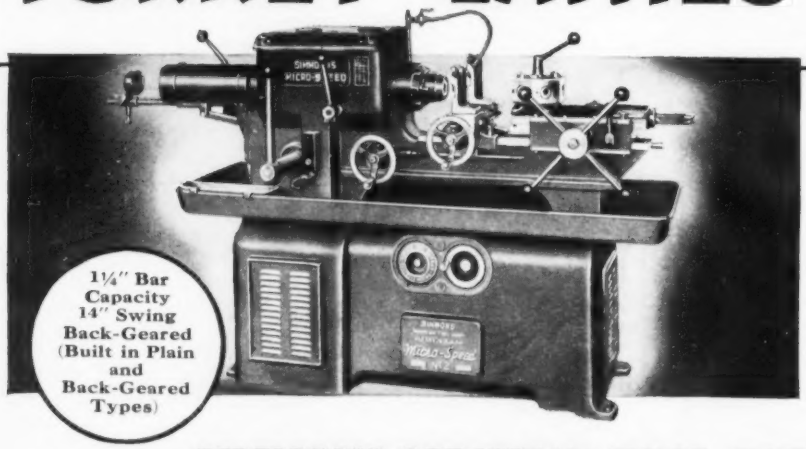
Product of AUTO-ORDNANCE CORPORATION

Thompson

1437 Railroad Ave., BRIDGEPORT, CONN.

HIGHER PRECISION *FASTER*

with these *Selector Dial Control* TURRET NO. 2 LATHES



1¼" Bar Capacity 14" Swing Back-Geared (Built in Plain and Back-Geared Types)

Mechanization for war demands unlimited production of a myriad of precision parts in record-breaking time. This problem, further complicated by the ever-growing shortage of skilled workers, can be overcome with modern, sturdy, simple-to-operate tools.

Simmons No. 2 Turret Lathes answer these requirements fully. They produce close-tolerance work *speedily and economically*, with a minimum of confusing devices. For example, the Micro-Speed Drive offers unlimited speed variations and all changes can be made while the spindle is in operation. This enables quick selection of the speed best-suited to the work and cutting tools. A simple oversized brake brings the spindle to rest quickly.

Write TODAY for descriptive bulletin detailing other features and complete specifications. Our delivery schedule is reasonably quick!

SIMMONS MACHINE TOOL CORPORATION

Main Office & Plant: **1759 NORTH BROADWAY, ALBANY, N. Y.**

New York Office: **149 BROADWAY**

1-BLADE BREAKAGES
2-REJECTIONS BECAUSE OF POOR FINISH
3-FIRE HAZARD MACHINING MAGNESIUM
4-EXCESSIVE TOOL COSTS
5-EXCESSIVE BLADE SHARPENINGS
6-DECREASED PRODUCTION FROM HAND GROUND TOOLS
7-PRODUCTION LOSS FROM FREQUENT SETTING OF TOOLS AFTER SHARPENING
8-SUPERVISION NECESSARY WITH INEXPERIENCED HELP WHEN GRINDING
9-SECOND FACING OPERATION NECESSARY DUE TO POOR FINISH OF CUT-OFF
IF THESE ARE Your PROBLEMS
IN CUTTING OFF OPERATIONS

HERE ARE YOUR ANSWERS

Use Empire Tool Company's

LUERS PATENTED

Cutting-Off Blades

BECAUSE:

1 They are scientifically designed and made of material that will withstand shock and resist abrasion.

2 The hollow-ground top causes chip to collapse and thus pull away from sidewalls of cut so surfaces are of unusually fine finish.

3 A combination of proper and accurate machine-ground clearances contributes in successfully reducing friction to minimum.

4 Luers Blades have longer life; they are usable within an inch of their entire length.

5 The space created by the collapsing action of the chip in pulling away from the sidewalls allows the coolant to reach the cutting edges.

6 Being machine-ground accurately to definite standards, Luers Blades always possess the required uniform clearances.

7 Special Holder permits ease of blade removal and quick replacement in exactly same position without disturbing setup

8 Grinding is simplified. Only front face of blade is ground. All other surfaces remain unchanged; constant clearance is maintained.

9 The free cutting action obtained through the collapsing of chip prevents chip binding on the face of piece being cut off. In most cases, this eliminates second facing operation.

Luers Patented Cutting-off Blades and Holders are produced by Empire Tool Company under license issued by John Milton Luers Patents, Inc.

BUY WAR BONDS

Send for copy of new complete catalog showing diagrams, sizes, and prices of blades and holders.

The Blades That Reduce Friction

EMPIRE Tool Co.

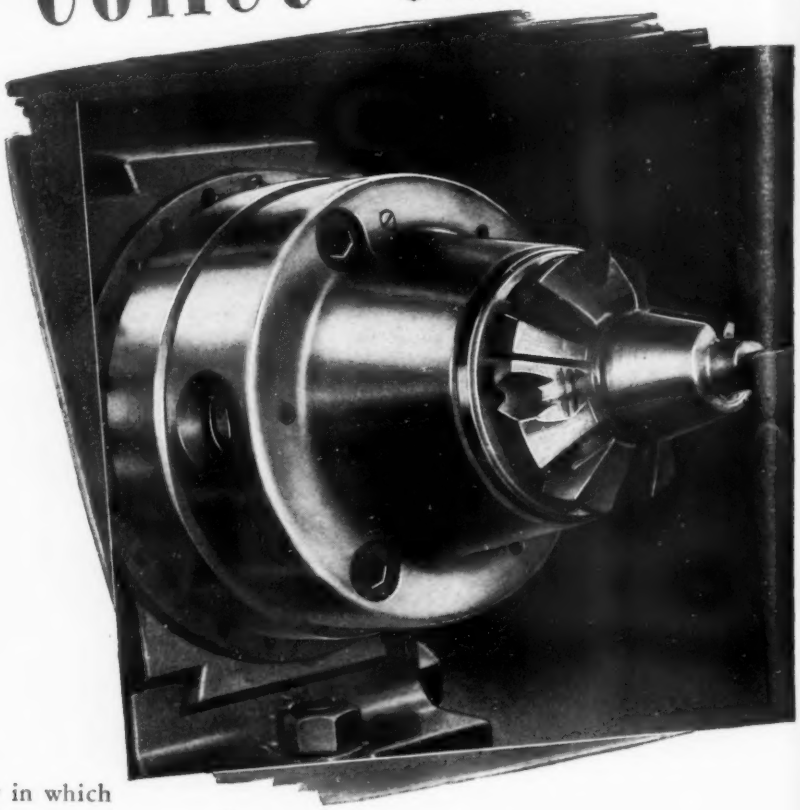
8778 Grinnell Ave.
Detroit, Mich.

nose-type collet chuck...

simplifies set-up

for ACCURATE

milling of pinions



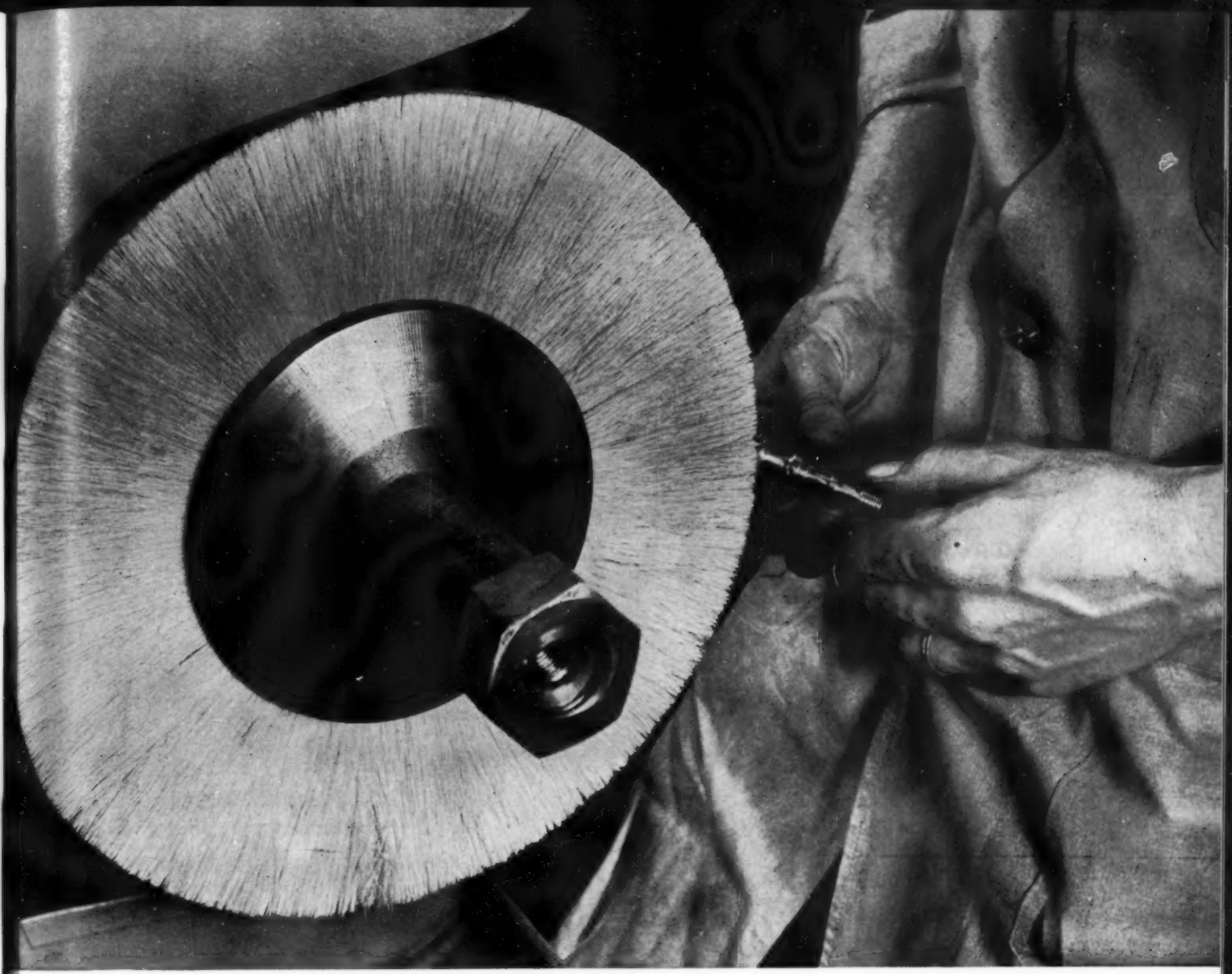
Here's just one example of the way in which precision nose-type collet chucks can be quickly and easily adapted to handle work that might otherwise necessitate special equipment. The chuck is mounted on the dividing head of a standard milling machine and the work is the milling of teeth to close limits of accuracy on bevel pinions of special design. Collets have been machined to provide clearance for the milling cutters and, by changing to collets of different capacities, a variety of sizes of pinions can be handled.

Especially important, in a set up of this kind, is the ability of the chuck to maintain consistent accuracy in centering of the work, a feature assured by the uniform full-length bearing grip of the collets in Cushman precision nose-type collet chucks.

Every day, Cushman Engineers are helping chuck users to solve special chucking problems presented by the many new types of work called for in armament production and to conserve and utilize to the full chucking equipment already available. Feel free to call upon us for the help you may need. The Cushman Chuck Company, Hartford, Connecticut.

CUSHMAN

A World Standard for PRECISION



The brush-off that steps up horsepower —thanks to O. B. A.

TO extract every last ounce of horsepower from an aircraft engine, its hundreds of moving parts must be polished—

—Polished to eliminate tool-marks, scratches and other stress concentration points

—Polished to break sharp corners and form radii

—Polished to dig out impurities, expose imperfections

But how to polish great numbers of irregularly shaped pieces—many with sharp angles and deep recesses—accurately, quickly and economically?

That was the problem presented by a major engine builder to Osborn men conducting an O.B.A. (Osborn Brushing Analysis) in the plant. Their recommendation was power-driven "Fascut" Tampico sections, soft but tough, and chemically treated to prevent "flutter" and "knifing", to hold abrasives better, cut faster and wear longer. So successful were these Osborn brushes in blending metal surfaces, rounding corners and exposing minute flaws that brushing with Tampico sections today is virtually standard practice throughout the entire industry.

The Osborn Brushing Analysis (O.B.A.) is available now as an engineering service for increasing production, improving quality and cutting costs in essential war industries. After Victory this same service will be available to all. For details about this service and help on specific problems, get in touch with the Osborn Brushing Specialist in your district, or write *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland, Ohio.*

Osborn Brushes

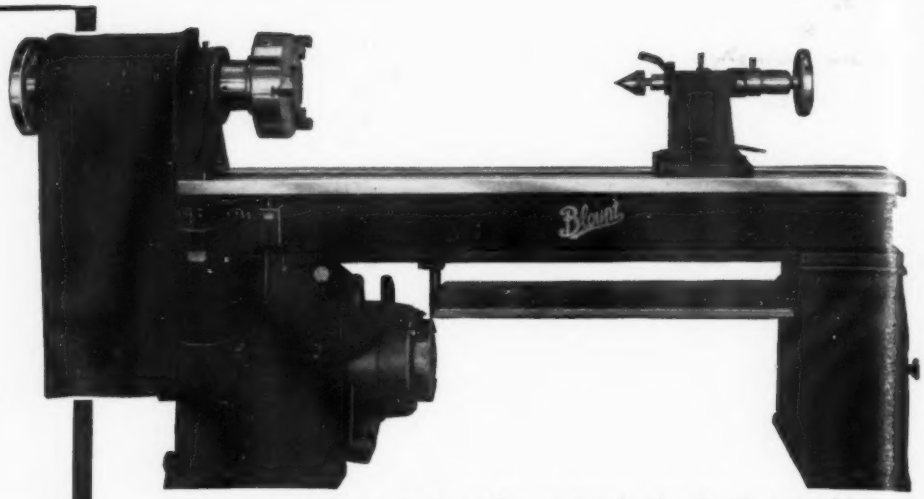
WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

"Blount"

MODEL B-3

Special Application

LATHE



. . . a **NEW DESIGN** *for turning, chucking, polishing and lapping*

Ask for Bulletin D-18 giving detailed information on this machine.

This recent addition to the Blount line, equipped with a ¾ HP. 4 speed reduction motor 515, 850, 1125, 1725 R.P.M., for spindle speeds of 41 to 421 R.P.M. Also can be supplied with a ¾ HP. 4 speed motor headstock 300-450-600 and 900 or 300-600-900 and 1800 R.P.M. for all standard voltages. It has a 20" swing and 8' bed and can be furnished also for a 24" swing. Lathes can also be furnished with hand feed carriage and compound rest.

Convenient control is provided by controller with reversing switch mounted on outside of headstock leg.

Other details of the Model B-3 include:

Spindle nose 3½" dia. 6v. threads per inch, maximum hole in spindle up to 2½" if desired. Bed 10¾" x 9½" deep with 3" wide shot. Tailstock base 10½" x 10½" with 1¾" dia. spindle with 6" travel and No. 3 Morse taper for center. Lathe Chuck 12" with safety locking screws. Rear hand wheel 11" dia. Standard equipment includes belt and belt guard.

J. G. BLOUNT COMPANY *Everett, Mass., U.S.A.*

INCREASE TAP LIFE 1000%

with the Blake Tap Grinder

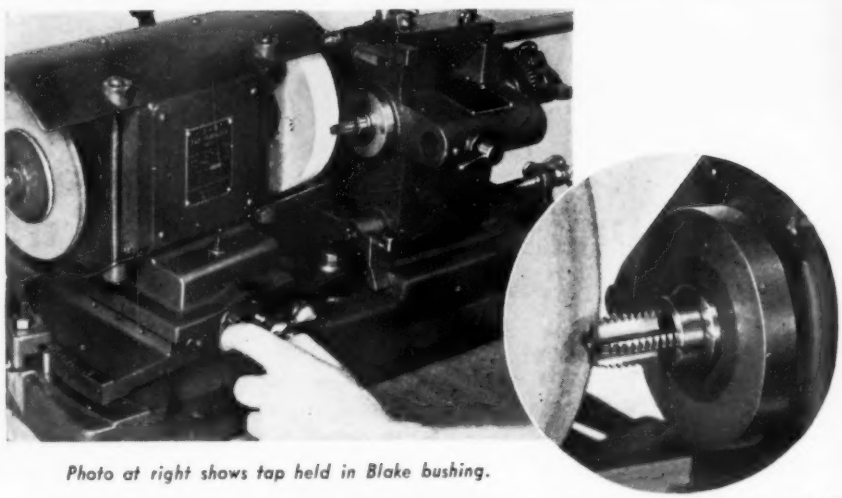


Photo at right shows tap held in Blake bushing.

Dull taps are not scrap taps when you have a Blake Tap Grinder on the job. This machine sharpens taps on the chamfer so that from 2 to 10 times more tapped holes are obtained from taps that formerly went on the scrap pile.

You *profit four ways* with the Blake (1) you conserve scarce High Speed and Carbon Steels, (2) you increase tap life up to 1000%, (3)you avoid the delay caused by waiting for new tap delivery, (4) you maintain the accuracy of your products.

The Blake Tap Grinder (formerly called the J-B) will grind the chamfer on right- or left-hand taps with 2, 3, 4, 5, 6, 8 and 10 flutes. Capacity —No. 0 to 2".

Many manufacturers are getting added profits from their Blake Tap Grinders by sharpening countersinks and other small tools on this versatile machine.

Please send folder giving complete details on the Blake Tap Grinder.

NAME ..... TITLE .....

COMPANY .....

STREET .....

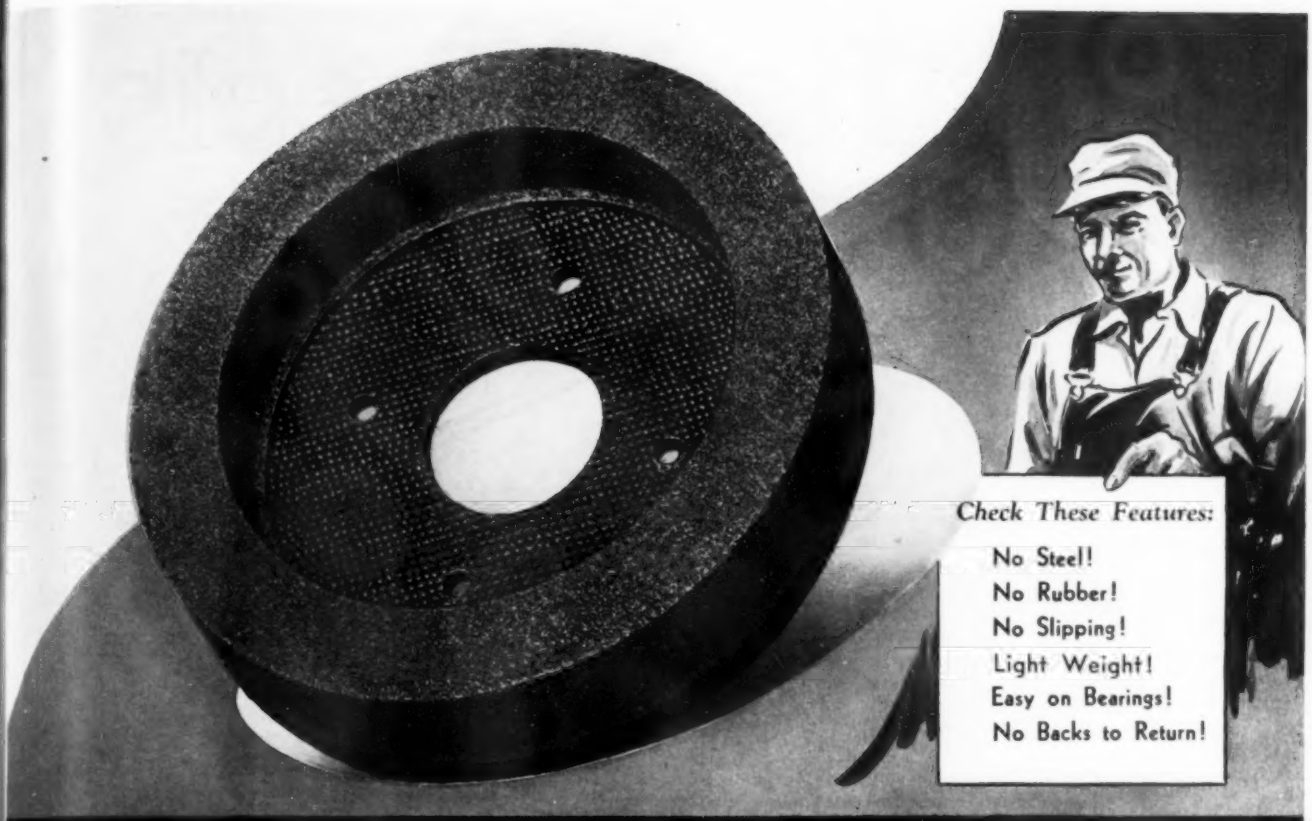
CITY ..... STATE .....

A. M.

EDWARD BLAKE COMPANY

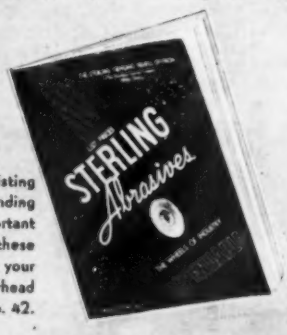
634 COMMONWEALTH AVE., NEWTON CENTRE, MASS.

BLAKE TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS — L & D HIGH SPEED DRILL PRESSES



STERBACK – Sterling's New, Better Grinding Wheel For DELTA, EXCELLO, PROSSER, SELLERS, BALDOR, HEALD, FINN GRINDERS

STERLING'S STERBACK Grinding Wheel is a new grinding unit for use on Tungsten Carbide Bits, radius on high speed tools, and drill points. They are an entirely new development in which every machinist will be interested. They employ no steel, no rubber - quicker delivery is assured. They are lighter in weight, easy on bearings. They eliminate the return of steel plates.



An entire listing of Sterling Grinding Wheels is important for you to have these days. Send on your company letterhead for Catalog No. 42.

The flexibility and light weight of the material out of which the back plate is made results in many advantages which lengthen the wheel's life and improve its cutting action.

These new wheels provide a more efficient unit for grinding . . they have been thoroughly tested on various jobs and machines. They are recommended as lasting, efficient, time-savers that you need on your wartime work. Use them with confidence.

· STERLING ABRASIVES ·

THE STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

Vitrified Wheels

VITRIFIED

. . . *for*

intricate precision grinding or coarse heavy work

Inasmuch as Vitrified manufactures a complete line of Grinding Wheels in numerous grades, grain combinations and bondings, it is merely a matter of selecting the right wheel for the work to be handled.

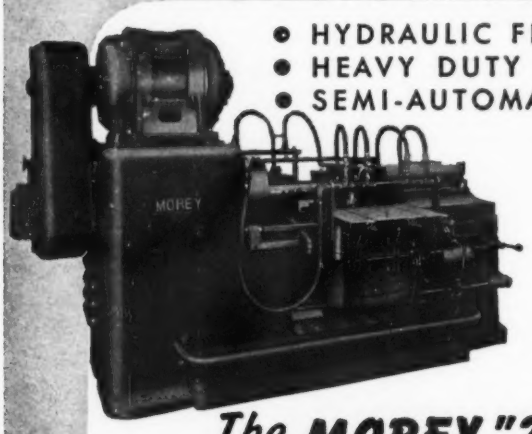
Because of this wide selection, a Vitrified Wheel can be depended on for economy, speed, and long life in the specific service for which it is intended.

Whether your work involves roughing, finishing, surfacing, edging, or cleaning, hand, automatic or swing grinding, there is a Vitrified Wheel which will give you maximum service at minimum cost.

Why not call in a Vitrified representative to show you how you can make worthwhile saving in your grinding operations?

VITRIFIED WHEEL CO., WESTFIELD, MASS.

Suitable for 105 M.M. to 155 M.M. Shells



- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC

The MOREY "27" SHELL LATHE

Timken Tapered Roller Bearings for Main Spindle—All Others Anti-Friction

The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

L-W

DIVIDING HEADS

- Larger Worm Wheel
- Ball Bearing Worm Shaft
- Larger Spindle with full length tapered bearing.
- Threaded Spindle Nose
- No. 10 B&S Taper in Spindle
- Larger and heavier Headstock and Tailstock

Furnished in Right or Left Hand Models

SEND TODAY FOR FREE CATALOG

Also Mfr's of: MAGNETIC CHUCKS—DEMAGNETIZERS—MILLING MACHINE VISES—POWER HACK SAWS—LATHE CHUCKS.

Shipping Weight 200 lbs.

11" FULL UNIVERSAL DIVIDING HEAD

MODEL AU—$194.65

11" UNIVERSAL INDEX CENTERS

Shipping Weight 125 lbs.

MODEL BP—$128.55

L-W CHUCK CO.
5 N. ST. CLAIR ST. TOLEDO, O.

AUTOMATIC FINISHING MACHINE

BURRING, BRUSHING, POLISHING OF PLATED OR BASE METALS

Have you a problem in Burring, Brushing or Polishing plated or base metals in plane or tank parts, bomb parts or shells? See the illustration at left for a few of the many parts this Hammond Automatic can handle. Its scope for finishing operations on a wide range of parts is unlimited. Send in samples of rough pieces you have, together with one acceptable finished piece for a complete engineering report. The only obligation is to yourself to investigate this offer to help you increase your production of parts and "help speed us toward Victory." Don't delay — do it now!

A FEW OF MANY PARTS FINISHED ON HAMMOND AUTOMATICS

Hammond OF KALAMAZOO

CARBIDE TOOL GRINDERS

MODELS 10 AND 14 NO SPRAY—NO SPLASH CARBIDE TOOL GRINDERS

NEW! NO SPRAY-NO SPLASH WHEEL GUARDS

"You're Dry When You Grind Wet"

Scientifically designed wheel guards protect operator during wet grinding operation — provide greater working area around the wheels and maximum light for higher efficiency and assured accuracy in grinding Carbide Tools.

Models 10 and 14 are each supplied with two Silicon Carbide Cup Wheels; 2 and 3 HP motors in-the-base respectively delivering full power to spindle through multi V-belt drive. They are each supplied with two large, generous size tables and equipped with removable compound protractor tool gages which travel in table slot provided. Wheel dresser without diamond is standard equipment on each machine.

WRITE FOR BULLETIN 201 also showing Chip Breaker Grinder

Hammond OF KALAMAZOO — CARBIDE, TOOL and SNAGGING GRINDERS · ABRASIVE BELT SURFACERS · AUTOMATIC and OD-CYLINDRICAL FINISHING MACHINES · POLISHING LATHES ·

Hammond Machinery Builders INC.

★ ★ ★ 1618 DOUGLAS AVENUE ★ ★ ★

KALAMAZOO • MICHIGAN

EASTERN BRANCH 71 W. 23rd STREET, NEW YORK CITY

TO THE LINE OF **PRODUCTO**
MODERN MACHINE VISES

An entirely new idea in Vise construction in this Country. For machining keyways and slots in shafts or spindles — range of sizes ⅜″ to 3⅛″ diameter — suitable for vertical or horizontal mounting. Setting of Vise remains unaltered for all work diameters and insures accurate radial cuts. Shafts correctly located in V jaw by equal movement of two jaws. Hardened V jaw reversible in Vise.

Size of Base 8″ x 7¼″ — Approximate weight 80 lbs.

Write for circular

PRODUCTO

The PRODUCTO MACHINE COMPANY

990 HOUSATONIC AVENUE BRIDGEPORT, CONNECTICUT
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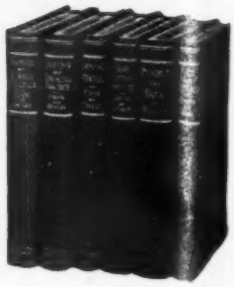
Increased Production

means more jobs for

MACHINISTS

—and MORE PAY for men who know their work



This big home-study and reference course gives you the practical facts on machines and methods you need to advance in machine shop work. Take advantage of the other man's experience as found in books, to solve your problems, increase your efficiency with

AMERICAN MACHINISTS' LIBRARY

6 volumes, 2516 pages, 2368 illustrations, many charts and tables

THESE books answer your questions on methods and machines—tell what you need to know about the operation of machines of all types and sizes for the whole range of metal cutting, forming, and finishing operations —show by text, diagram, and illustration the essential points of setting up work, adjusting machines, selecting feeds and speeds, determining pressures, handling materials, devising short-cuts, etc.

Puts the mastery of machine-shop work at your fingertips

With these books at hand for quick reference, no job is too hard or unusual, and the routine jobs may be improved, with savings in time and trouble and reduced wastage.

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—complete guide for everybody, from shop executive to apprentices, interested in the operation of machines used in turning and boring practice
—description of all important varieties of machines, both manual and automatic, and methods of operating them
—data on speeds and feeds, new cutting alloys and materials, use of coolants, etc.
—practical information on grinding machines and abrasive wheels, showing what they do, how to operate them, and how to make best use of them on various types of work.
—training in the various operations performed in drilling and surfacing materials in the machine shop
—exact, descriptive data on all aspects of gear-cutting practice useful in shops of any size
—essentials of selecting machines, setting up work, and handling operations in reaming, tapping, planing, shaping, slotting, milling, and broaching

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Send me the American Machinists' Library, 6 volumes, charges prepaid, for 10 days' Examination. If I find the books satisfactory, I will send you $1.50 in 10 days, and $3.00 a month until the special price of $19.50 has been paid. Otherwise I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

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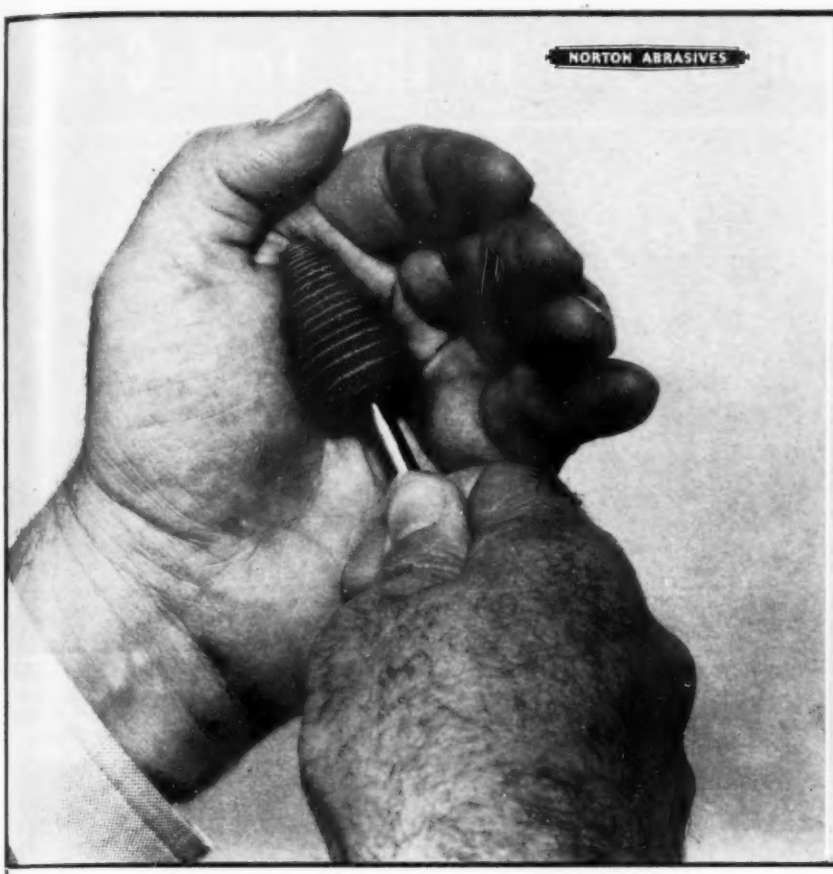
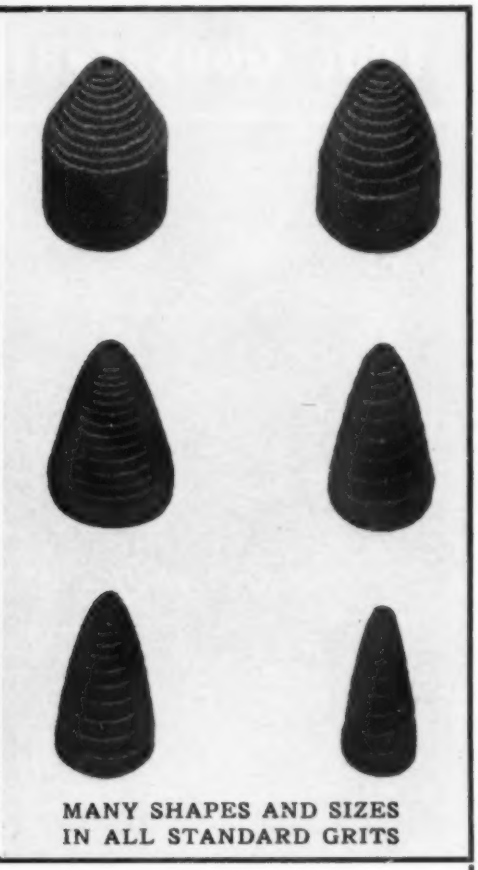




MANY SHAPES AND SIZES
IN ALL STANDARD GRITS

THEY'LL SPEED YOUR SANDING OF RECESSED METAL PARTS

The illustration shows how they snug into low, curved areas

Spirapoints
TRADE MARK

OF METALITE CLOTH

Their tapered shape, their resiliency, their presenting of ever new cutting surface to the work—all these make our *brand new*, ready-to-use abrasive cloth "gadgets" the fastest finishing attachments for your portable and flexible shaft tools.

Jobs that you try to finish by hand—at high cost and loss of time—are whisked through when these little spirally wound points are the business end of your high speed machines.

You can get many more shapes and sizes than the few illustrated, and all standard grits. So whether you want to remove excess metal with a grit like 36 or produce a high finish with a number as fine as 320, they're ready to do a far better job with astonishing speed and economy.

We'll gladly show your operating men how many times faster Spirapoints work *right on your own toughest finishing jobs.* Just phone the nearest branch.

Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Grand Rapids, High Point, Indianapolis, Los Angeles, New York, Philadelphia, St. Louis, San Francisco, Tacoma.

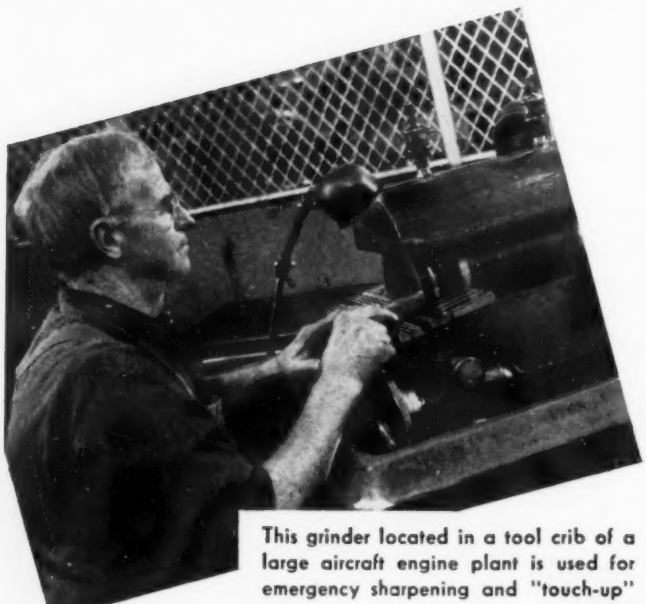
BEHR-MANNING (DIVISION OF NORTON COMPANY) **TROY, N.Y.**

Pioneers of Better Coated Abrasives Since 1872

Tool Conservation begins in the Tool Crib

This Tool Sharpening Department under the supervision of an experienced tool engineer assures that every tool in the plant's cribs is in excellent condition.

GET ALL THE *Good* OUT OF *Good Taps*



This grinder located in a tool crib of a large aircraft engine plant is used for emergency sharpening and "touch-up" jobs.

Maintenance of tools in proper working condition multiplies their life many times. Even those which have become badly worn, rusted or chipped — that seem to have outlived their usefulness — may often be salvaged to give valuable additional service.

Many large plants maintain separate tool sharpening and salvage departments. But the small shop or departmental tool crib may easily do an outstanding job if equipped with a small grinder and a few attachments.

• • •

For helpful information on how to keep taps at peak efficiency, send for *"Greenfield's"* new booklet, "How To Sharpen A Tap."

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IN '43 *and in the Future...*

SPEED *YOUR* PRODUCTION with SIMPLEX MACHINES

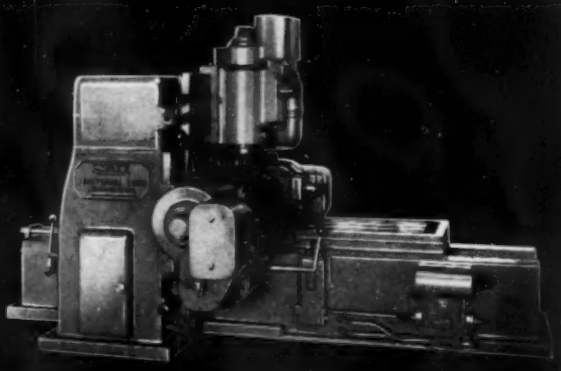
Right now your production must reach new peaks. Victory depends on it! . . . In the peace to follow, *competition* will demand in your shop a continuation of this same efficient production.

Simplex Machine Tools are Precision Built for Precision Production

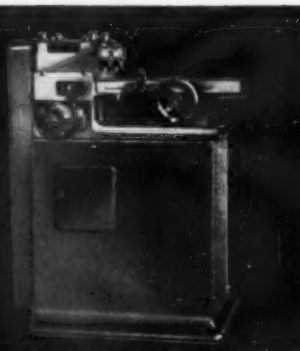
Profit with Simplex's high production, low cost, *accurate* boring and milling. Simplex Boring Machines are available in 25 types and sizes, in both mechanical and hydraulic feeds. Simplex Unit-Type Boring Machines may be had in single and double end, three or four way; also in knee and angular types. In addition, a wide range of models is offered in Simplex Planer-Type Production Milling Machines. Special production machine tools built to meet your individual requirements.

Get FREE Catalogs and Estimates *Today*

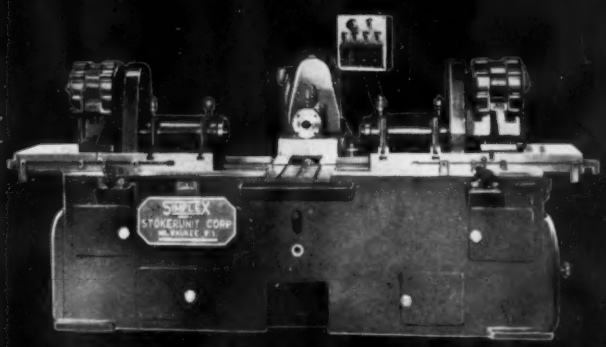
Send coupon now for FREE catalogs describing the many advantages of Simplex Boring and Milling Machines. Include blueprints of parts for FREE estimates and specific machine recommendations. There is no obligation.



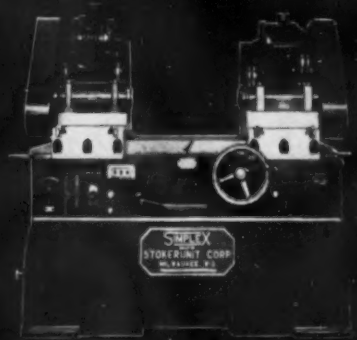
SIMPLEX PLANER-TYPE PRECISION MILLING MACHINES. For high production milling of duplicate parts, or for general-purpose face milling of similar parts. Available with 1, 2, 3 or 4 heads for simultaneous milling of several surfaces. (3-head machine shown.)



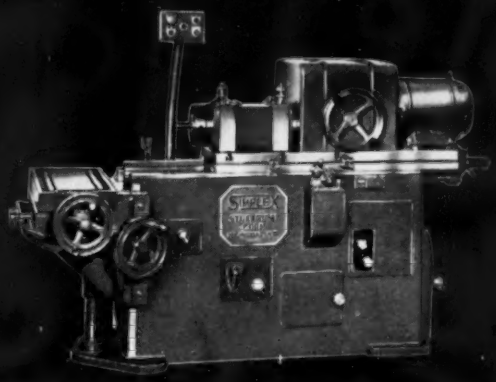
SIMPLEX PRECISION BORING MACHINE No. 1. Provides maximum economy and accuracy in boring small parts such as precision bearings, actuating cylinders, etc. With 1 or 2 spindles. (2-spindle machine shown.)



SIMPLEX UNIT-TYPE PRECISION BORING MACHINES. New flexibility provides wider application than conventional machines. Shown is No. 2U 3-Way Machine with 3 No. 3 spindles, arranged for boring differential housings, air and electric tool parts, governor housings, etc.



SIMPLEX PRECISION BORING MACHINE, SERIES 200, 4 spindles. Especially designed for shops where a large number of production jobs of varying types must be handled by one machine.



SIMPLEX KNEE-TYPE PRECISION BORING MACHINES. Model No. 3U, illustrated above, is equipped with No. 3 spindle, variable speed spindle drive, turret stop for table. Designed for accurate, precision boring, particularly where one machine must be used for a variety of jobs.

SIMPLEX DOUBLE-END PRECISION BORING MACHINE No. 1. Arranged for double-end operation in boring automobile steering spindles, etc. Work fixtures are mounted in the middle.

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☐ Boring Machines ☐ Milling Machines ☐ I enclose blueprints of parts for estimates and machine recommendations.

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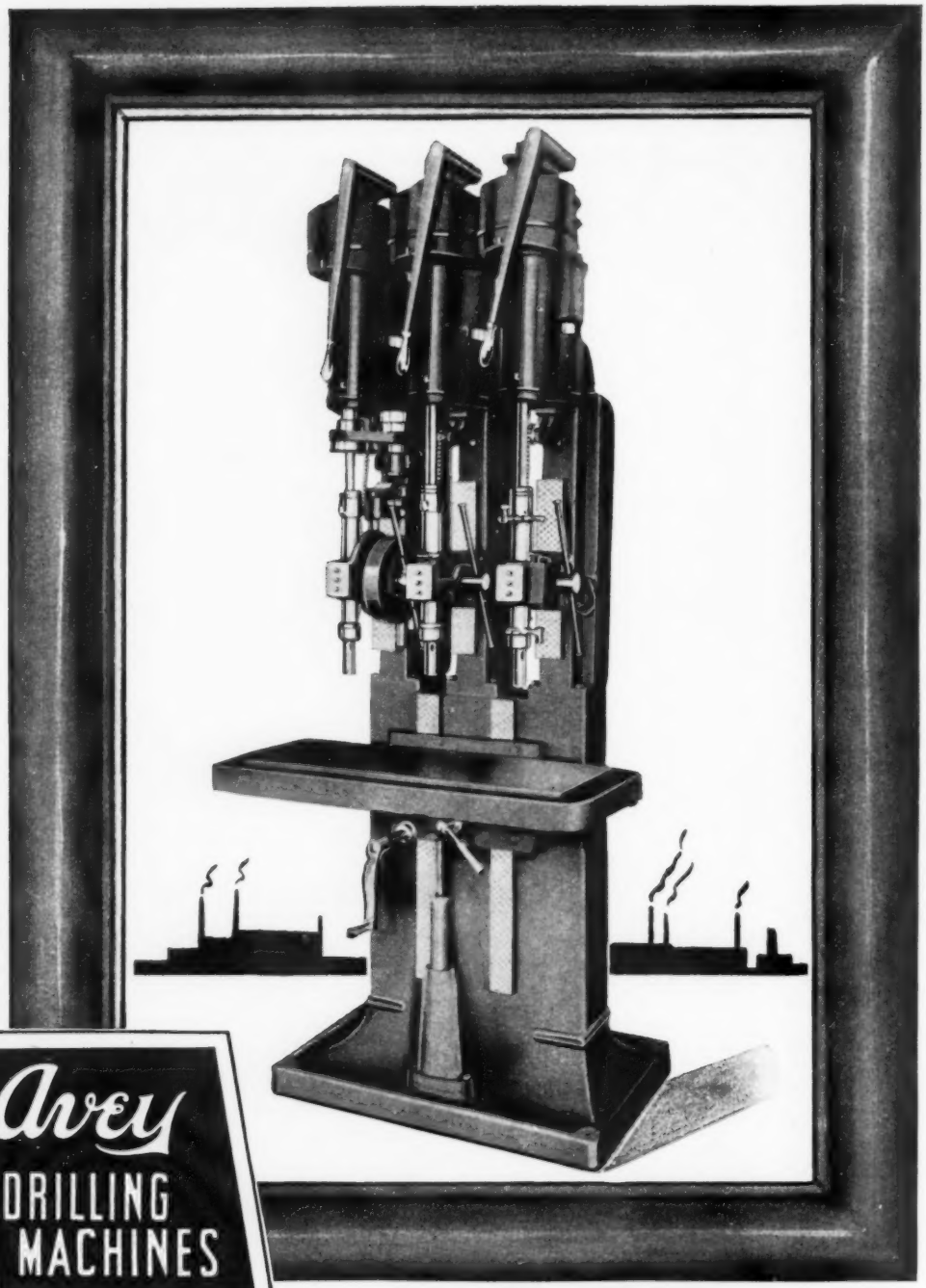

Avey DRILLING MACHINES

. . . In the Picture for 1943

Make sure it is in your production line for 1943. Avey Drilling Machines give longer operating hours, smoother performance and lower maintenance. They'll do your war job now, your peace job later. We illustrate the Avery Type MA-6 in No. 2 size *(Capacity in cast iron, ⅞").* **No. 3 size** *(Capacity in cast iron, 1¼").* **One to six spindle units, either size. Six speed machine, two speed motor, three mechanical changes through gearing, 8 to 1 speed range. Push button control. MA-6 illustrated, has three spindles, the Aveymatic Feed, Hand Feed and Tapper.**

AVEY DRILLING MACHINE CO.
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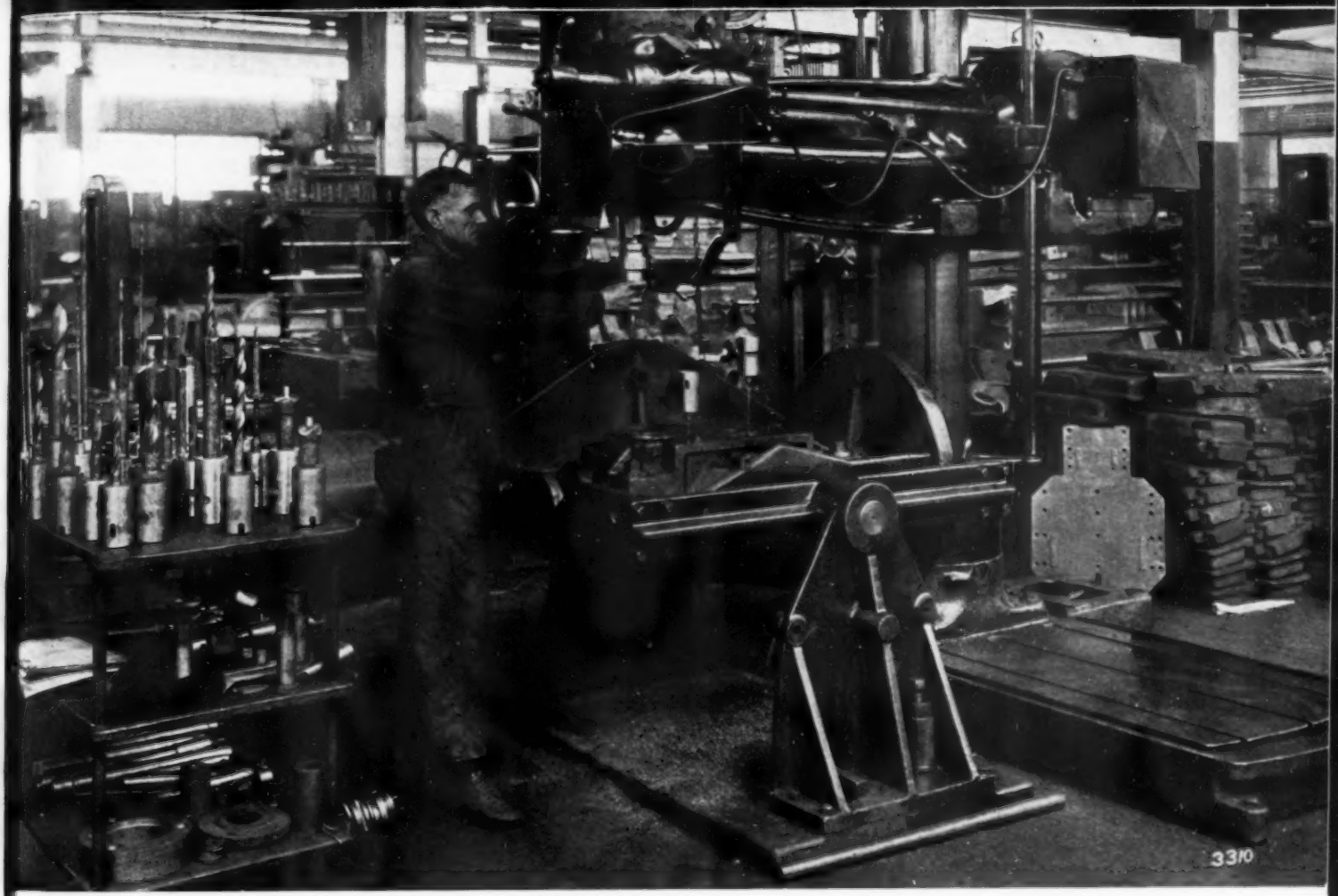
QUICK CHANGE CHUCK AND COLLET EQUIPMENT



Has reduced the idle time of revolving spindles to practically zero. With this chuck in revolving spindle machines, tools can be changed while the machine is running without stopping or even slowing down the spindle.

Send for a copy of Bulletin M-101 which describes Modern Chuck and Collet Equipment.

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If better production tapping is your objective, it will be to your advantage to come to Card. We can help you because we sell better tapping performance.

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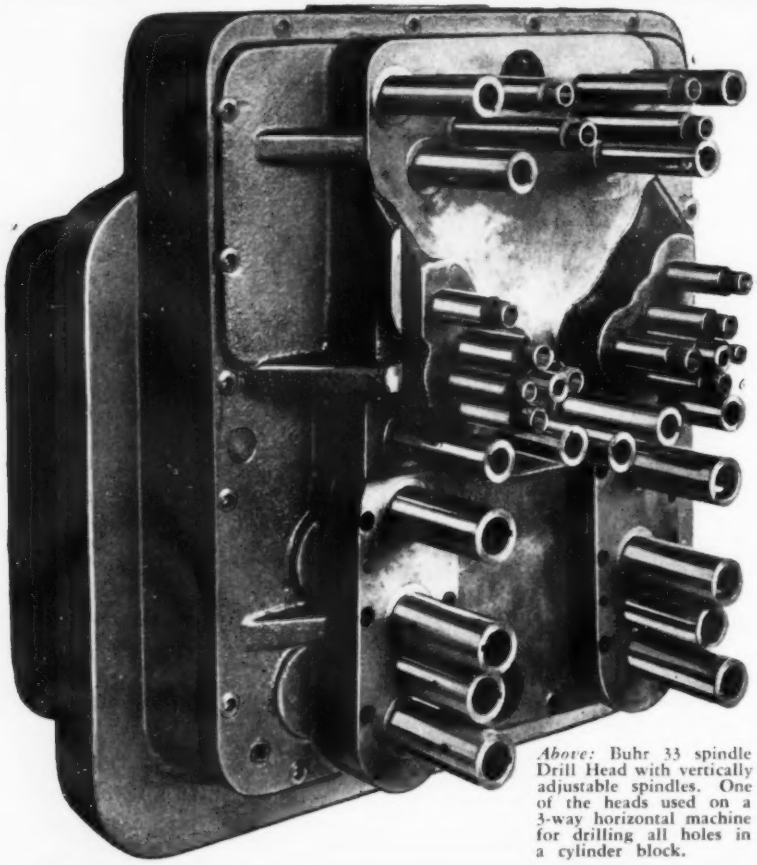

Above: Buhr 33 spindle Drill Head with vertically adjustable spindles. One of the heads used on a 3-way horizontal machine for drilling all holes in a cylinder block.

If it is a Multiple Production

Buhr

DRILL HEAD, it is good for 24 hour Production

• This is but one of many BUHR-designed drill heads now being used in night and day production to supply our fighting forces. Similar applications of BUHR Multiple Spindle Drill Heads *will* speed your work. Give them a trial in your plant. Send us your blueprints—we'll make suggestions and recommendations on the use of BUHR-engineering and equipment.

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Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment

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That is a profitable paradox for you. More true today than perhaps ever before. For here in the pages of this publication are packed many helpful ideas . . . considerable useful information. Much of it, in fact, available from no other source.

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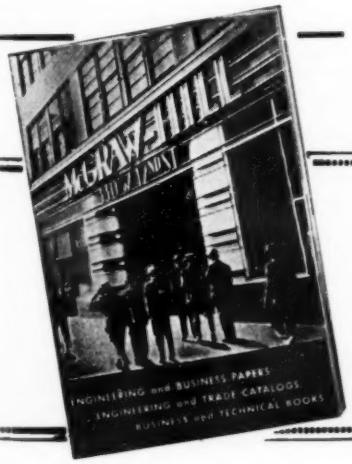

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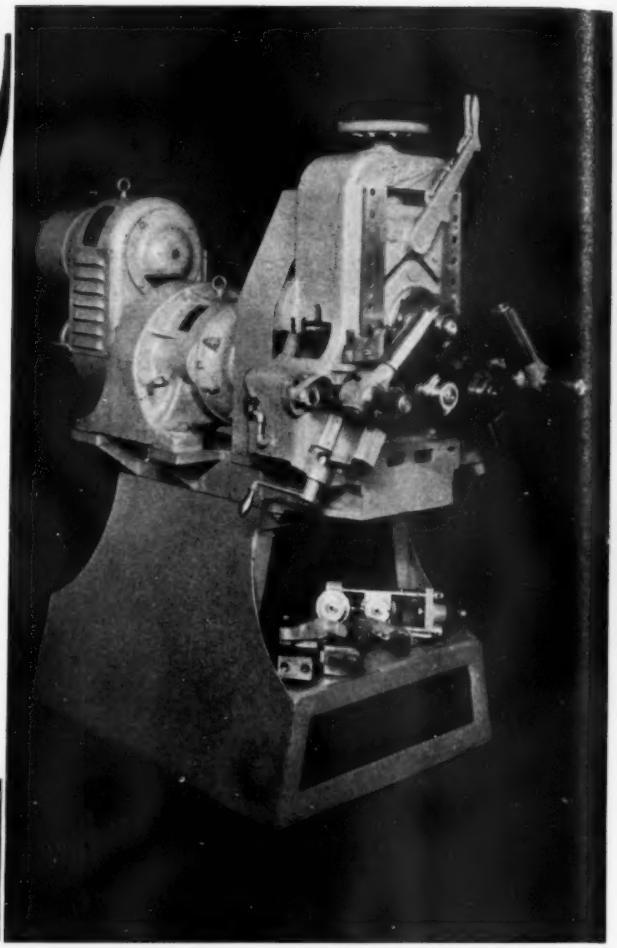

Buffalo Aircraft Type Bending Rolls are specifically designed for the aircraft industry to simplify and speed up bending operations—*and bend the production curve upward.* These thoro-bred tools embody every principal feature requested by the pioneers of the industry plus a "Four-to-One" Variable Speed Drive matched to today's exacting production demands.

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"Buffalo" AIRCRAFT TYPE BENDING ROLLS

Accurate, High-Speed

MOREY VERTICAL SHAPERS

8" STROKE
12" STROKE
14" STROKE

SELF-CONTAINED MOTOR DRIVE

Precision . . . Easily handled — your operators will appreciate it . . . **Cutting Stroke** changed quickly . . . **Feeds** varied instantly . . . **Power** rapid traverse in all directions . . . **Brake** for ram automatically applied . . . **Bijur Lubrication** . . . **Timken Bearings**—Bull gear mounted on Timken Bearings. Roller table mounted on Timken Bearings . . . **Modern Design**—built to the highest standards of workmanship and materials—simplified operation, powerful yet finger-tip control

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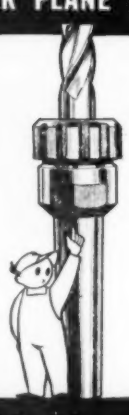

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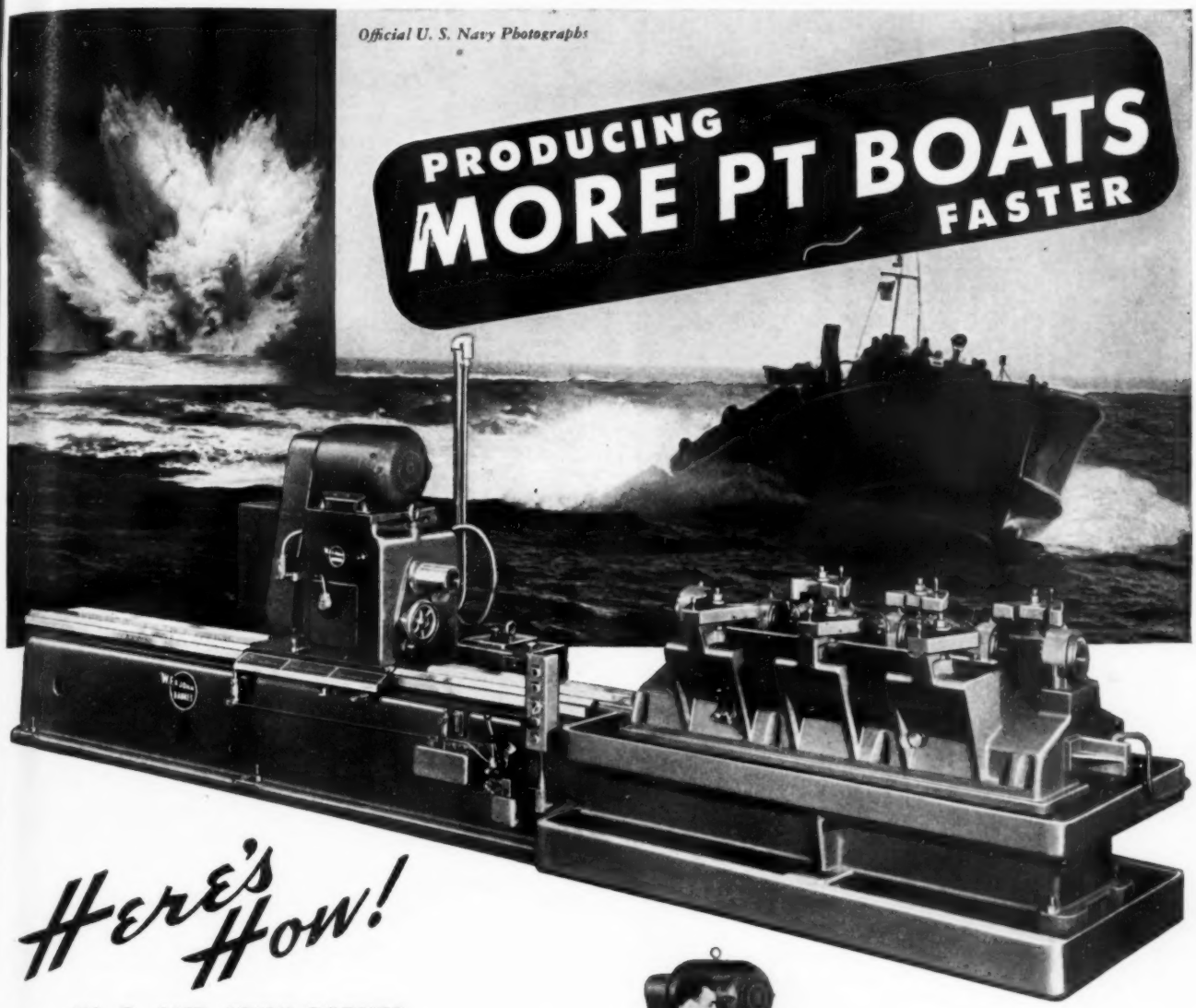
PRODUCING MORE PT BOATS FASTER



Here's How!

W. F. AND JOHN BARNES MACHINES SPEED THE PRODUCTION OF

THESE FIGHTING CRAFT

★ The two W. F. and John Barnes machines illustrated here are speeding the production of the marine motors used in our rapidly expanding fleet of PT boats.

The machine shown above, used for boring the main bearings, is equipped with hydraulically-actuated feed and traverse, and is of our unit design. The part is elevated by means of cam and crank arrangement to permit inserting of multi-tool line boring bar. Perfect alignment of bearings is assured.

At the right, is a machine designed for facing both sides of main bearings with one set-up—eliminating the laborious and time consuming methods previously used. By using W. F. and John Barnes machines like the one shown, only ONE set-up is required. The positive hydraulic feed of the part to one set of milling cutters and reverse feed to another set of milling cutters, provide a fast and accurate means of holding close limits and assuring consistant duplication of machined parts.

FREE PRODUCTION AND TOOLING IDEAS. *Eight bulletins, each describing and tracing a machining problem from the original study of the part to the final machine design, will be sent to you upon request. Write for these bulletins today.*

W.F.&JOHN BARNES

W. F. and JOHN BARNES

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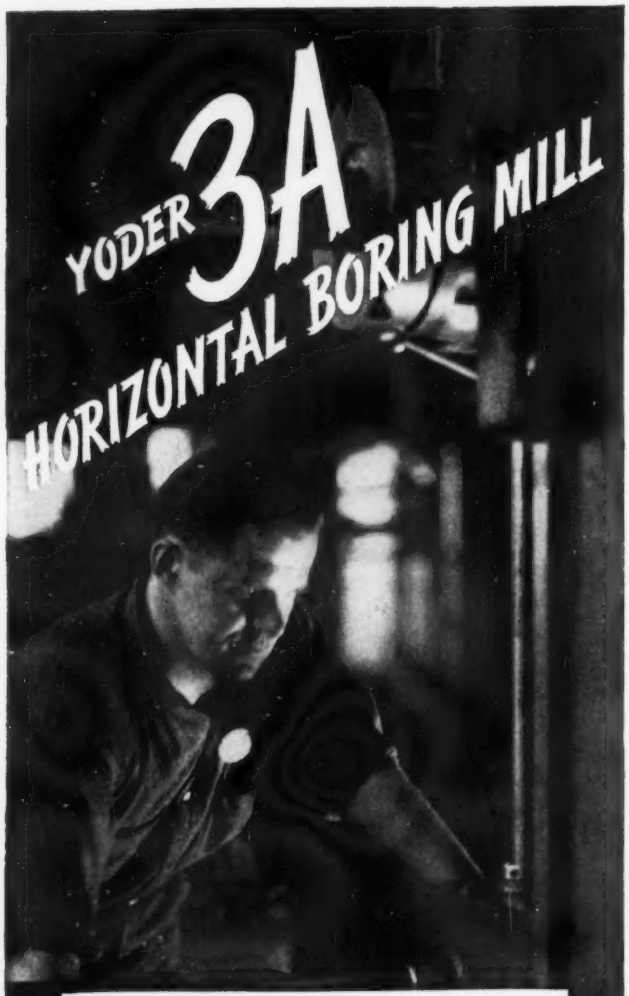

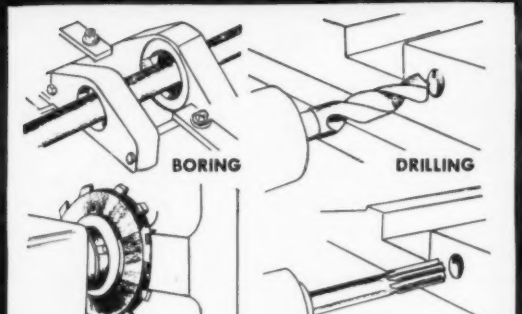

Add the advantages of POWER TOUCH CONTROL and POWER FLOW DRIVE to the other exclusive advantages of the YODER 3A HORIZONTAL BORING MILL. These make it the newest, most flexible and soundly engineered of this popular type of multi-purpose machine tool.

War production now . . . . postwar production eventually, will make a Yoder 3A Horizontal Boring Mill a MUST as a general utility tool in a large majority of machine shops.

Reasonable delivery dates are again possible.

Let us hear from you.
We have a bulletin.

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. . . TIPPED WITH TUNGSTEN CARBIDE
Assure Greater Production and Accuracy in the finish grinding of bullet cores, armor-piercing shot, shells, projectiles, tank parts, aircraft engine parts, rifle and machine gun parts.
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METAL CARBIDES CORPORATION
YOUNGSTOWN, OHIO

PUT MORE PRESSURE ON PRODUCTION

Famco Arbor Presses speed hundreds of production and assembly jobs. Front and side gib adjustments assure perfect ram alignment at all times . . . eliminate "shimmy" resulting from wear. Choose from *40 stock sizes and models* of Famco Presses, floor and bench types. Write today for details. There is no obligation.

Famco Machine Company
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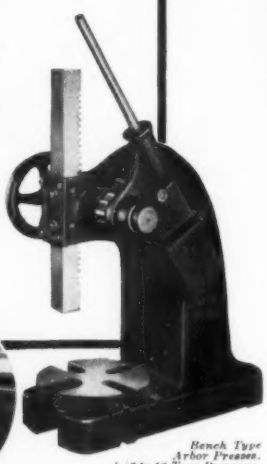

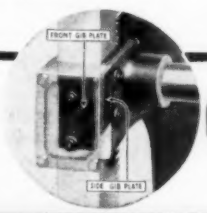

Simple adjustment of front and side gib plates gives positive control of ram alignment — eliminates any variance. Exclusive with Famco.

Bench Type Arbor Presses. 1/2 to 12 Tons Pressure.

famco FOOT AND ARBOR PRESSES

ENOUGH! IN TIME!

PROMPT DELIVERY!

Performing its continuing tremendous commitments on schedule, Reed-Prentice is still in a position to offer prompt delivery on its new and improved Vertical Milling Machines. More popular than ever the improved No. 3VG Miller is widely used by manufacturers of gun and aircraft engine parts. It excels in die and tool-making. Spindle speeds range from 100 RPM to 4000 RPM.

No. 4 VERTICAL MILLER

The entirely new No. 4 features centralized controls governing every movement of table, cross-slide, and head. Hydraulically actuated screws insure positive drive to table and cross-slide.

SPECIFICATIONS

TABLE:	Working surface	24" x 84"
RANGE:	Longitudinal travel of table . . . (Can be furnished 60")	48"
	Cross travel of cross slide	24"
	Vertical travel of head	12"
	End of spindle to table—Max. 24", Min.	12"
	Throat depth	33"
	Top of table to under side of cross slide ways	19¾"
MISC.:	Net weight	20,500 lbs.

AGENTS

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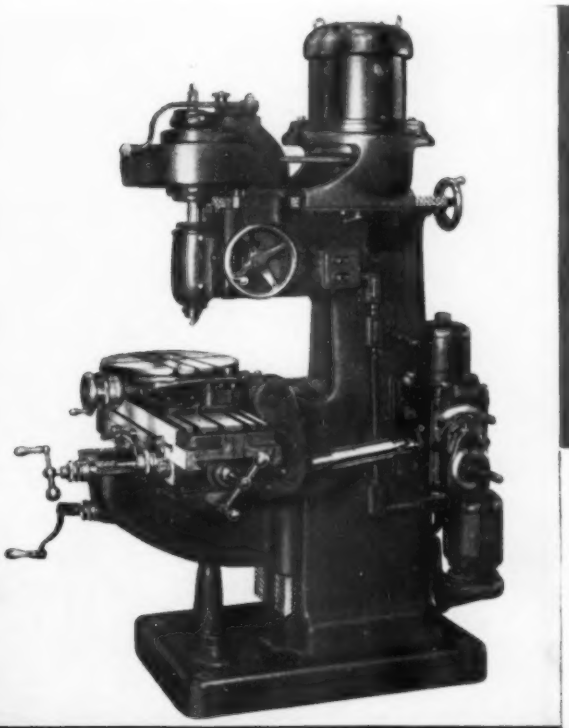

No. 3VG VERTICAL MILLER

SPECIFICATIONS

Longitudinal Feed (Power)	24"
Cross Feed	12"
Vertical Adjustment of Knee	18"
Vertical Adjustment Head on Column	5"
Max. Distance, Spindle to Table . . .	18"
Max. Distance, Spindle to Frame . .	16"
Rotary Table, working surface . .	16½"
Machine Table, working surface	10¼" x 36"

ARMY NAVY

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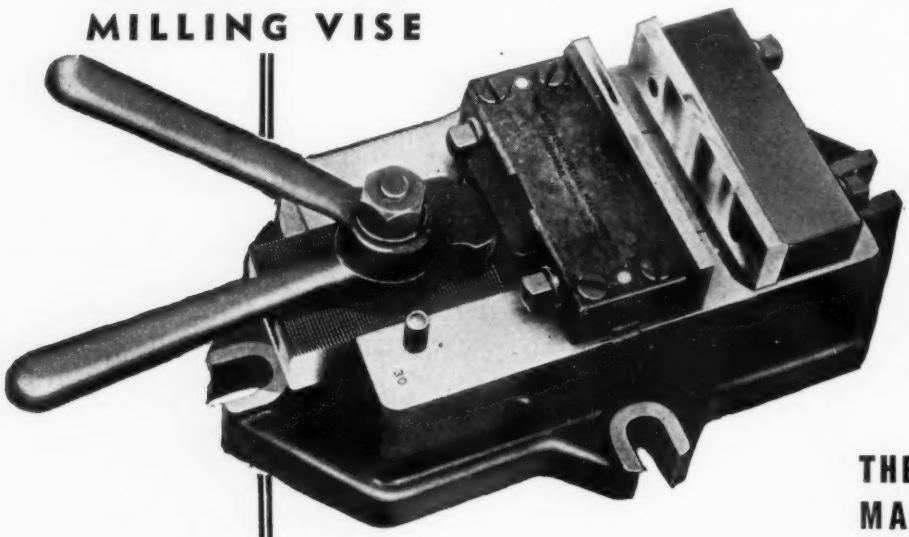
Boost small arms production milling with the "HARTFORD" *Quick-Acting* MILLING VISE

Power, speed, accuracy, strength and convenience are combined in the "HARTFORD" to assure the maximum in production. Specially developed for small arms milling, the "HARTFORD" offers time savings which are so important today in winning the battle of production.

Handling of all operations is accomplished by means of two levers. Quick opening and quick return are effected by the lower cam lever whereas work holding pressure is supplied by the top eccentric lever. With a little practice the operator can manipulate both levers by one hand, leaving the other hand free for other work. Release of eccentric binding lever and a quarter turn of cam lever opens movable jaw approximately ⅞ in. which is sufficient for easy chip clearance and also convenient for release of comparatively thin work. A unique feature of the "HARTFORD" is the position of the movable jaw which is that ordinarily occupied by the solid jaw on screw type vises. This location of jaw provides a construction which assures perfect jaw alignment and virtual indestructibility.



Screw holes of "HARTFORD" vise jaws are interchangeable with those of the No. 2 B&S Vise. Precision manufacture of all parts makes it possible to furnish replacement parts promptly from stock.

SPECIFICATIONS

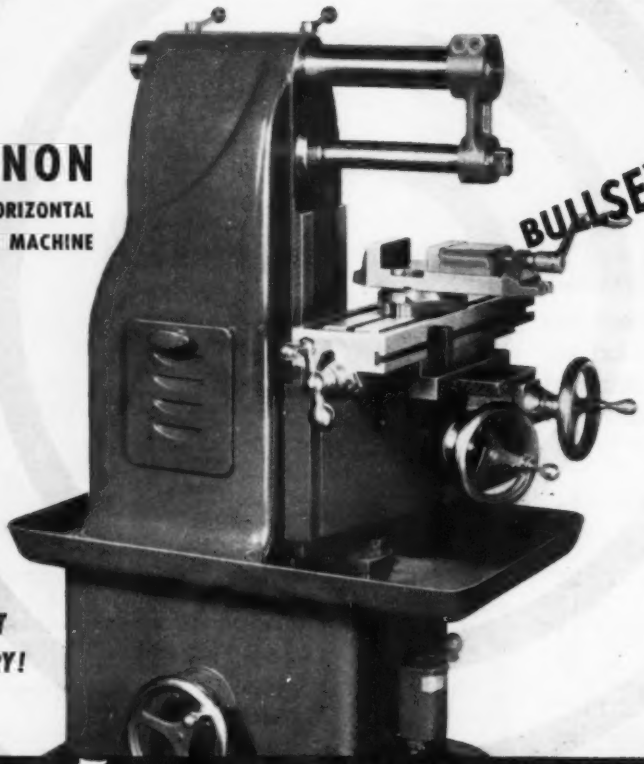
Made in Plain and Swivel Jaw Types
Width of Jaw—5"
Depth of Jaw—1-3/16"
Max. opening (Plain Jaw)—2⅝"
Max. opening (Swivel Jaw)—2¼"
Weight—40 =
Dimensions (overall) 13" long—8" wide—5" high

THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD CONNECTICUT

Write today for complete information

VERNON
NO. 0 HORIZONTAL MILLING MACHINE

BULLSEYE FOR PRODUCTION



Powerful 1 h.p. motor, sturdy compact design, and precision construction make the Vernon No. 0 Horizontal Mill the pick of the field for production.

By using the accessory equipment* especially designed for the Vernon, almost any milling operation is quickly and easily accomplished. See the Vernon at your Dealers!

Bulletins are available featuring the Vernon Vertical Mill and Jig Borer, Vernon No. 0 Mill and Vernon 12" Shaper. Write today!

*Longitudinal power feed (standard extra), vertical milling attachments, rotary tables, swivel-base vises, coolant systems, index centers, boring heads, etc.

PROMPT DELIVERY!

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON -- LOS ANGELES, CALIFORNIA
Vernon Line of **HORIZONTAL MILLS, VERTICAL MILLS & JIG BORERS, 11" SHAPERS & GRINDERS**

GREEN HANDS WORK EFFICIENTLY WITH KENT-OWENS MACHINES

Kent-Owens 1-14V Vertical Milling Machine

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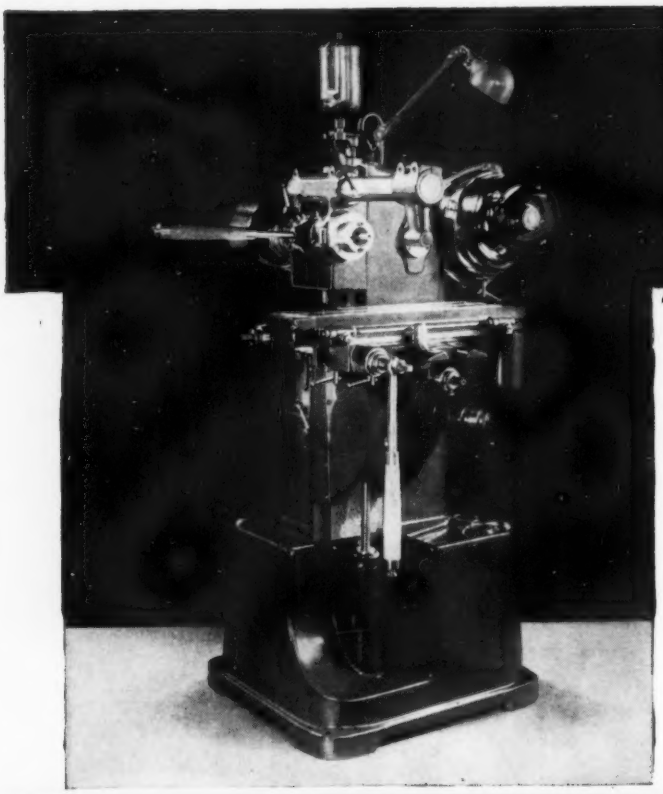
Oatis-Booth Machinery Co.
KANSAS CITY
Eichman Machinery Co.
LOS ANGELES
Eccles & Davies Machinery Company
Harron, Rickard, & McCone
MILWAUKEE
Neff, Kohlbusch & Bissell
MOLINE
John J. Normoyle Co.
MONTREAL
F. F. Barber Machinery Co.
NEW ORLEANS
Oliver H. Van Horn Co., Inc.
NEW YORK
Wilson Brown Company
PHILADELPHIA
Calco Machinery Company
PITTSBURGH
Barney Machinery Co.
ROCHESTER
F. W. Schiefer Machinery Company
SAN FRANCISCO
C. F. Bulotti Machinery Co.
SEATTLE
Star Machinery Company
ST. LOUIS
Blackman & Nuetzel Machinery Company
Clarke Equipment Co.
SYRACUSE
J. F. Owens Machinery Co.
TORONTO
F. F. Barber Machinery Co.
WALKERVILLE
F. F. Barber Machinery Co.

● Get your milling jobs done *right* . . . with men or WOMEN operators . . . by depending on Kent-Owens Machines! They're rugged . . . simple . . . efficient . . . designed with practical features that green hands quickly learn to master.

Experienced shop men today more than ever appreciate Kent-Owens advantages that are so important to faster, better production. No matter how tough the job . . . call on Kent-Owens! Send for latest bulletins. Contact your nearest representative or write us direct.

Kent-Owens Machine Company, Toledo, Ohio.

Call on KENT-OWENS *for Milling Machines*



THE NICHOLS HAND MILLER

» A modern, convenient machine for the volume production of accurate parts . . . .

In the "NICHOLS", the usual features of the hand miller have been combined with a ruggedness of design and construction which makes it a truly production machine tool offering high cutting speeds, maintained precision and long life. A wide variety of operations can be handled at top speed and reduced cost as compared with the same work produced on larger slower machines.

Because of its precision, great versatility and quick set-up, the Nichols Hand Miller is particularly adapted to tool room requirements. Its wide use in this class of service by leading manufacturers is evidence of its recognized value and suitability in meeting the requirements of modern shops.

•

Capacity: Longitudinal Feed, 10"; Transverse Feed, 7"; Vertical Feed of Knee, 13½"; Vertical Movement of Head, 4½", Working Surface of Table, 6½" x 21"; Spindle Speeds, 100, 200, 600 and 1200 R.P.M.

Send for Illustrated Bulletin giving Complete Information

W. H. NICHOLS & SONS *Waltham, Mass., U.S.A.*

PLANATHREADING

THE HALL PLANETARY PATENTED MILLER

2 THREADS MILLED AT COST OF ONE

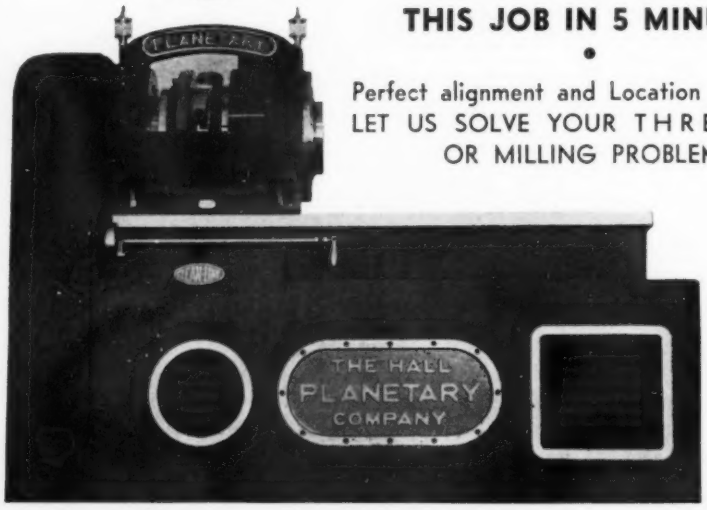
A Real Saving

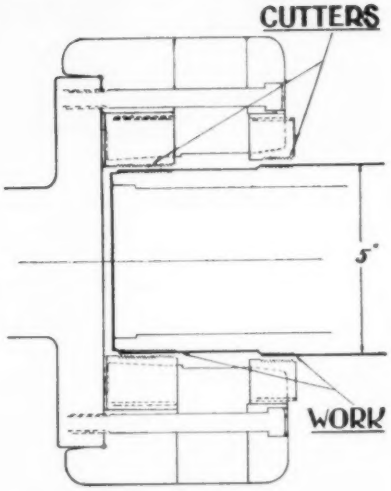
•

THIS JOB IN 5 MINUTES

•

Perfect alignment and Location of Threads
LET US SOLVE YOUR THREADING OR MILLING PROBLEMS

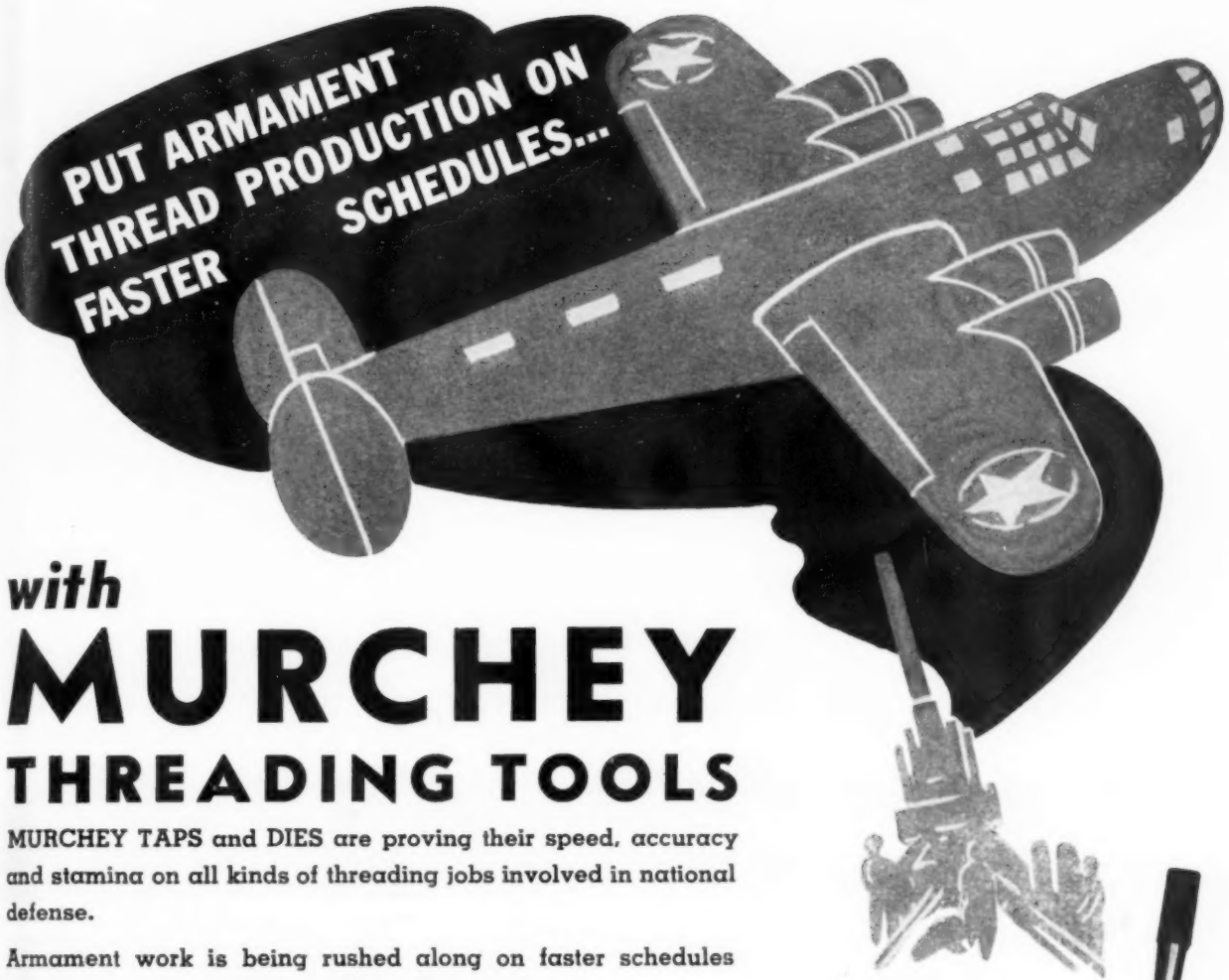




THE HALL PLANETARY CO.

Fox and Abbotsford Avenue

PHILADELPHIA, PA.



with

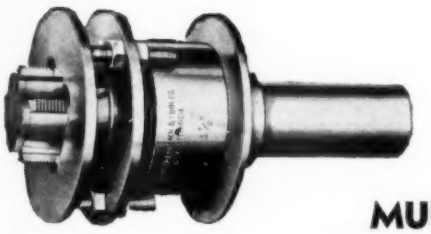
MURCHEY

THREADING TOOLS

MURCHEY TAPS and DIES are proving their speed, accuracy and stamina on all kinds of threading jobs involved in national defense.

Armament work is being rushed along on faster schedules through the use of Murchey Threading Tools.

If you are facing threading problems in your production, take advantage of Murchey's long experience. Consult Murchey NOW!



MURCHEY TYPE "M" COLLAPSIBILE MACHINE TAP

The Type "M"—designed for fast, accurate thread production—provides instant, positive collapse and accurate thread lengths. It is adjustable for thread size. Sturdiness, strength, speed and dependability, are assured by the Type "M".

MURCHEY TYPE "G" SELF-OPENING DIE HEAD

This non-rotating, self-opening die head—for use on hand screw machines—can be depended on for long-run production of fine quality threads. It is fast, accurate and long lived. Head is hardened and ground; opening is positive and instantaneous; closing is by hand. Adjustable for size, the Type "G" will speed up thread production on a wide variety of work.

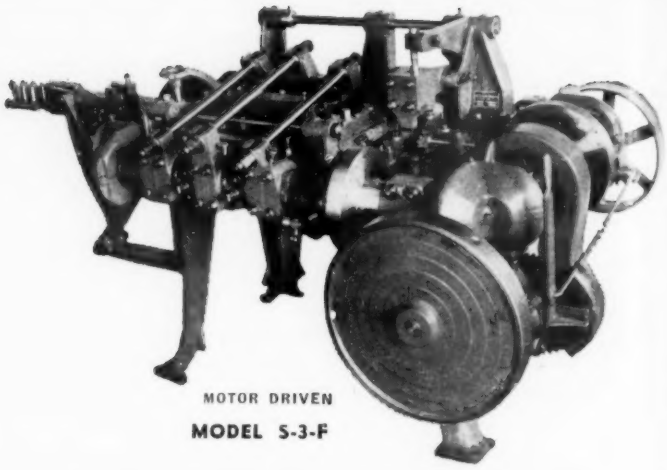
MURCHEY ALSO MANUFACTURES

Thread Milling Machines, Shell Tapping Machines and Roller Pipe Cutting Off Machines, all types of Die-heads and Collapsible Taps.

Murchey MACHINE & TOOL CO.

.....DETROIT, MICHIGAN

STEP UP PRODUCTION OF FORMED PARTS



MOTOR DRIVEN
MODEL S-3-F

. . . with the NILSON AUTOMATIC METAL and WIRE FORMING MACHINES

Today's requirements for higher efficiency, greater speed and products of greater uniformity and accuracy are met in the new NILSON RIBBON STOCK FORMING MACHINES. These machines are the achievement of over fifty years accumulated experience in designing and building metal forming machines. Careful selection of materials and skilled workmanship result in machines that are famous for long life and low maintenance.

FEATURES THAT CONTRIBUTE TO BETTER, FASTER WORK

Superior features of the NILSON four-slide forming machines are the result of long experience and include:

. . . open construction of press and forming tools.
. . . patented slide feed which has an independent cam-operated wire gripping device.
. . . transmission of power operating wire feed through a straight line.

Send for 4-page circular giving further information as well as detailed specifications of sizes and capacities.

• •

We have been engaged in the design and production of special automatic machinery of high production capacity for over thirty years. We are prepared to render a complete service in connection with the design and production of automatic machinery of every description. Consult Nilson on your requirements.

THE A. H. NILSON MACHINE CO... *Bridgeport, Conn., U.S.A.*

Here at last is an OUTSTANDING high-production COLD METAL SAWING MACHINE—

Cuts stock from 3 inches up—Handles multiple cutting of small bars or shapes . . . . . .

The outstanding high capacity and speed of this new 8" Porter-McLeod machine—for general work or for production work in single or multiple units—are attained through modern, unique features of design which assure faster, cleaner, more accurate cutting.

Upper feed of the machine permits "nesting" of economical quantities of bars or shapes using our systems of multiple or interchangeable "nests" which give support to each nest on both sides and bottom.

To insure accuracy and protect against blade damage at times when hard spots are encountered in cutting, friction disc feed is provided. Further protection is assured and weaving and buckling prevented by supporting the blade close up to its rim and by *pulling the blades upward through* the cut. This method of feed and drive also results in lower power requirements and straight cuts under all conditions.

Standard feed is 3 inches per minute. This, however, can be stepped up for cutting such materials as brass or other non-ferrous metals.

Investigate the Porter-McLeod Production Cutting-Off Machine Today. Details available promptly on request.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.

MACHINE TOOL COMPANY

. . . CRANE-EQUIPPED PRESSES

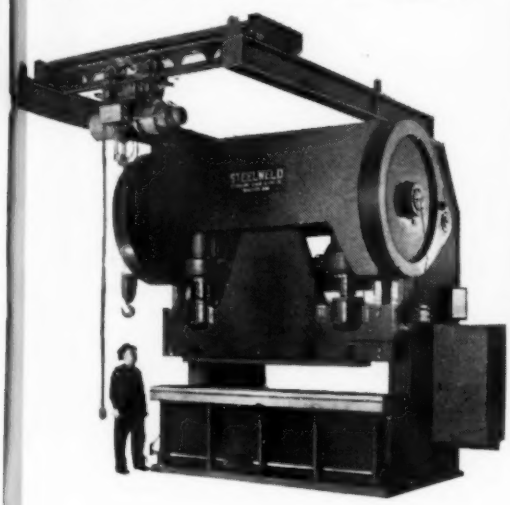
for Heavy Bending and Plate Straightening

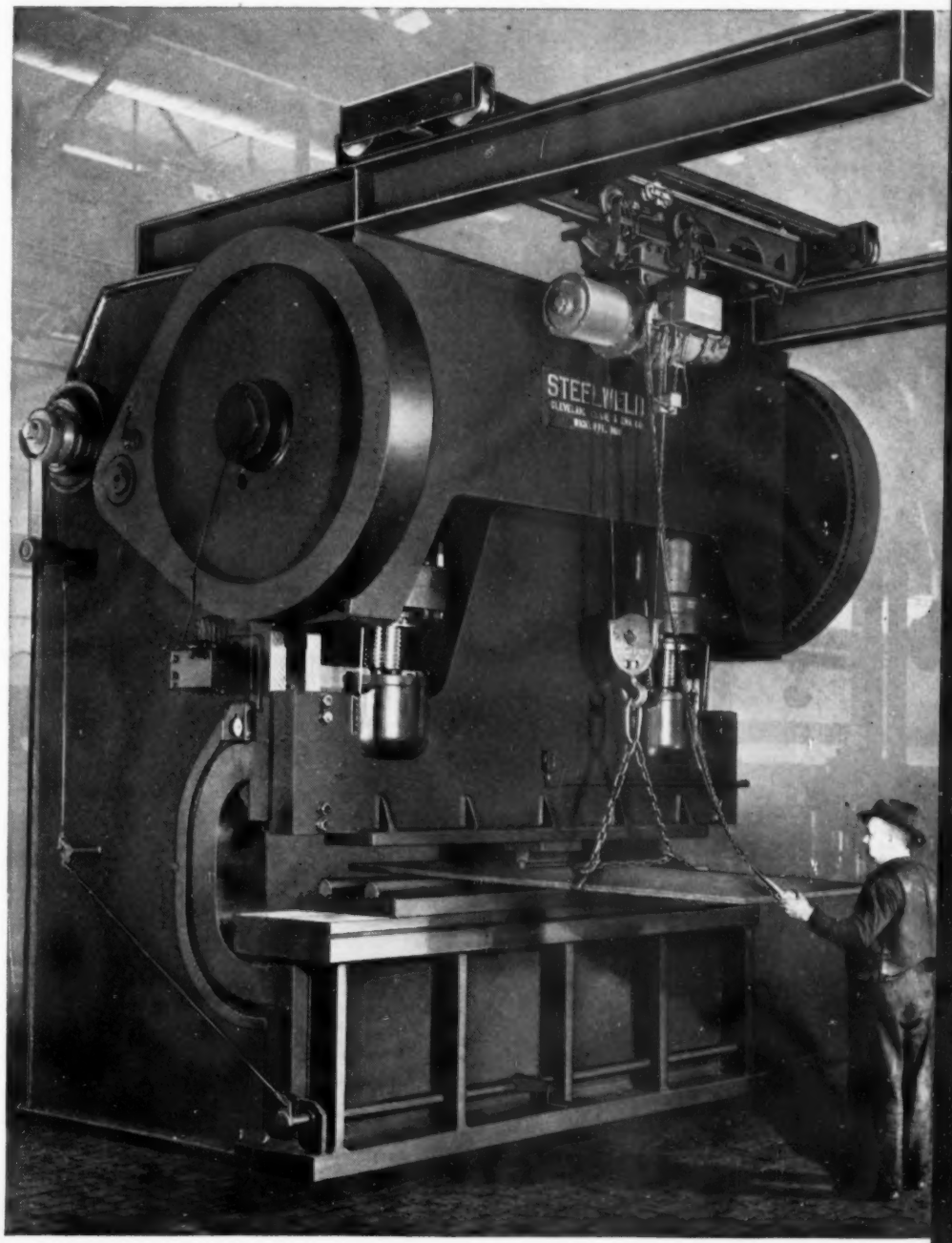
The handling of heavy plate being formed or straightened in bending presses often is a very serious problem. In some shops costly overhead cranes or other handling equipment is tied up a large part of the time with such work.

Some of the larger Steelweld Bending Presses are now being equipped with individual overhead traveling cranes which make it an easy task for an operator to handle heavy cumbersome plate in and out of the machine as well as to support it during press operations. The cranes are fabricated by Cleveland Tramrail and usually are hand-propelled with an electric hoist for the heavy lifting.

All Steelweld Presses now catalogued and nearly all older models now in service can be equipped with Cleveland Tramrail press cranes. The cranes are easily adapted to Steelwelds because all shafting is located at the rear of the machines away from possibility of being snagged and damaged by crane hooks, heavy plates, etc.

The application of individual cranes to presses is just one of many features pioneered by Steelweld to make press operation easier, faster, safer and better.





Model Mo5-8 Steelweld Press. Normal capacity 500 tons. Equipped with especially wide bed top and ram bottom to accommodate dies necessary for plate straightening.

ATALOG No. 2002 gives complete construc-

GET THIS BOOK!

THE CLEVELAND CRANE & ENGINEERING CO.
STEELWELD MACHINERY DIVISION
1127 EAST 283RD STREET • WICKLIFFE, OHIO.

MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSES

STEELWELD
BENDING PRESSES

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

METAL STAMPINGS

• TOOLS • DIES •

PERMANENT MAGNETS

HEAT TREATING

THOMAS & SKINNER

STEEL PRODUCTS CO.

1103 E. 23rd St. — INDIANAPOLIS, IND.

SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.

Thirty Irving Place — New York City

36 years experience in metal fabrication.

MACHINE SHOP

Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmenship assure your satisfaction. Your inquiries invited.

C. VANDEGRIFT CO.

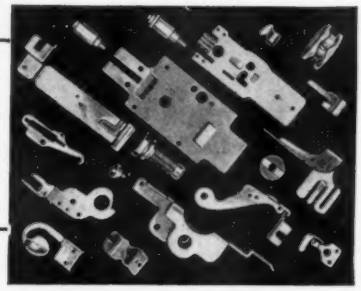
HOCKESSIN — DELAWARE

★ *Machine Tool Work Wanted For:*

2—Turret Lathes, 1½" diameter bar capacity.
1—Milling Machine, table size 7" x 38".
1—Engine Lathe, 16" swing x 30"
2—Engine Lathes, 13" swing x 28".
300 A.M.P. Arc Welder, and various other small machines.

WAYNE MANUFACTURING CO. — Honesdale, Pa.

STAMPINGS AND ASSEMBLIES IN ALL KINDS OF METALS



Fast and efficient service on long or short runs is guaranteed by our modern equipment and methods, backed by 50 years of experience.

We also offer facilities for the manufacture of screw machine products, tools, dies, jigs and fixtures.

Quality work by skilled mechanics is assured. Send your blueprints or samples today!

"GREATER SAVINGS WITH GREIST"

THE GREIST MFG. CO.

546 BLAKE ST. — NEW HAVEN, CONN.

Over 25 Years Experience Designing JIGS, FIXTURES, DIES, GAUGES SPECIAL MACHINERY

Prompt Service—Reasonable Rates

D. M. HELLER ENGINEERING COMPANY

134 N. LaSalle St. — Chicago

COMMERCIAL HEAT TREATING

Seasoning of Steel, Nitriding
Centerless, Broach, Thread Grinding
Magnaflux & Optical Testing
Metallurgical & Chemical Laboratories
Cadmium & Hard Chrome Plating

AGERSTRAND CORPORATION

Muskegon, Michigan

• Machines and Parts, • Special Tools and Fixtures, • Cam Milling, on Contract

Your engineering problems will receive efficient and economical service in our modern plant manned with skilled workers. Contact us today for prompt quotations on your blueprints or samples.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE CO., BRIDGEPORT, CONN.

Gray Iron and Semi Steel Castings, also alloyed with nickel, chrome, and molybdenum. Wood, Iron, Brass and Aluminum pattern work.

KING FOUNDRIES, INC.

Phone 823 — North Wales, Montg. Co., Pa.
22 Miles from Philadelphia, Pennsylvania

DESIGN & BUILD JIGS, FIXTURES & GAGES

REED MACHINE & TOOL ENG.

BOX 662

PAWTUCKET, R. I.

THE NORLIPP COMPANY

Engineers . . . Manufacturers

Sub-contract facilities for die castings and metal stampings

556 West Congress Street — Chicago, Illinois

WIRE AND METAL SPECIALTIES

In round, flat, square and special shaped wire in all metals.

LARGE PRODUCTION CAPACITY

Plating and finishing.

EASTERN TOOL & MFG. CO.

BLOOMFIELD, N. J.

For All Kinds of Castings, Large or Small

MATCH PLATE WORK A SPECIALTY

Put your pattern problems up to us—we will take care of them.

GENERAL PATTERN WORKS

PATTERNS in WOOD and METAL

2233 Buck Street — Cincinnati, Ohio

If you need

SCREW MACHINE PRODUCTS

write American Machinist's Contract Work Department for names of established manufacturers. If you make screw-machine products, you will find an advertisement on this page a profitable investment. Write today for complete details.

CONTRACT WORK

Advertisements on this and the preceding page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

KIRK & BLUM

CONTRACT MANUFACTURING
ACCURATE SHEET STEEL
STAINLESS STEEL, MONEL OR
OTHER ALLOY FABRICATION
OUR SPECIALTY
CAPACITY 3/8" AND LIGHTER

THE KIRK & BLUM MFG. CO.
2823 SPRING GROVE AVE. CINCINNATI, OHIO

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

for

Medium Heavy

SPECIAL MACHINERY

CONTRACT WORK SOLICITED

ROBT. HOLMES & BROS., INC.
JUNCTION AVE. DANVILLE, ILL

FORGINGS

• All types up to 8,000 lbs. Smooth Forged—Finished—Rough Turned, Hollow Bored and Heat Treated to Specifications. Crank Shafts—Shafting—Connecting Rods

BAY CITY FORGE CO.
ERIE PENNSYLVANIA

ATTENTION

INVENTORS and MANUFACTURERS

Plan NOW for after the War

We have a client who is now 100% in war work. Their machine shops have been expanded so that after the war they will have a capacity for taking on new lines.

For many years this concern has built textile machinery requiring precision and high grade of skill.

If you have a machine or product that you want to make after the war, it will probably be to your advantage to consult them. Their Engineering Department is in a position to assist you in developing your product, or invention, so that it will be ready for the market after the war. They are also able to assist you with the financing and probably make a place in their organization, in case they should take on your product.

If Interested Address

MAY ADVERTISING, Inc.
106 S. 16th STREET PHILADELPHIA

DOES IT WORK?

Is the Contract Work Section helping *American Machinist's* subscribers and readers find outside help when they need it? Does advertising in this section really do its job?

If you have idle equipment to put to work, you will want the answers to these questions. You can get them quickly by addressing CONTRACT WORK DEPARTMENT, *American Machinist*, 330 West 42d St., New York, N. Y.

SUB-CONTRACT WORK

WANTED for any

TUBING, BAR or SHAPE PRODUCTS or SHEET METAL PRODUCTS

Such as—
Conduit, Hydraulic and Pneumatic Lines
Shell Bands
Tubular Gun Mounts
Primer Tubes
Retractable Landing Gears

Such as—
Tank Parts—Chests
Work Benches—Tote Boxes
Ammunition Boxes—Shelving
Machine Tool Tenders—Bench Legs
Drawer Cabinets—Ration Boxes

Machine bases, Pedestals, Frames and Lathe Pans formed and arc welded.
Sheet metal fabrication. All kinds of press work. Stampings, Cover plates, Louvre panels.
Light and heavy fabrication and assembly.
Forming, bending, cutting off and machining of bars, tubes and shapes. No item or quantity too large or too small.

Graduate Engineers on Our Staff for Design Work

AURORA EQUIPMENT CO. AURORA, ILLINOIS
Phone - AURORA 9232

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00. (See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time individual salaried employment only), ½ above rates.

PROPOSALS. 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns — 30 inches—to a page.

A.M.

NEW ADVERTISEMENTS received by 10 A.M., January 11th will appear in the issue of January 21st subject to limitations of space available

WANTED

HYDRAULIC ENGINEER

with both Aircraft and Commercial experience for Development work. Old established company with excellent post war prospects.

P-355, American Machinist
520 No. Michigan Ave., Chicago, Ill.

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 33 years recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

COMPETENT AMERICAN engineer with broad experience in product design and production engineering for low costs and high production. Age 57. Salary $8,000. Good teacher. Can organize, supervise, and train others. PW-372, American Machinist, 330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES
OFFERED—WANTED
Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY OFFERED

MECHANICAL ENGINEER for a manufacturer of precision gears. Must have long selling experience in the same line. Write full details outlining educational background, names and addresses of former employers, territory covered. Exceptional opportunity for well qualified man. SW-373, American Machinist, 330 W. 42nd St., New York, N. Y.

OPPORTUNITY WANTED

MANUFACTURER'S representative would be interested in contacting responsible manufacturer who desires capable and conscientious representation in the Philadelphia district. Well established with good contacts capable of handling production, precision and maintenance equipment. Details of my qualifications should interest you. RA-371, American Machinist, 330 W. 42nd St., New York, N. Y.

PATENT ATTORNEYS

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet. "General Information Concerning Inventions and Patents" and "Fee Schedule" send without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on page Facing inside back cover.

WANTED

PRODUCTION MANAGER

For eastern gear manufacturing plant. Must have gear experience and ability to supervise production methods. Write full details of past experience, names and addresses of former employers, age, salary and draft status.

P-356, American Machinist
330 West 42nd St., New York City

REPRESENTATIVE

WANTED FOR

Complete line of finest quality diamond dressing tools, as well as highly perfected boring and turning diamond tools.

Exclusive territories available to aggressive Sales Engineering firm understanding the application of diamond tools, and having a concentrated coverage of their individual territories.

Please write giving complete qualifications in first letter.

RW-370, American Machinist
330 West 42nd St., New York City

Capital Available for Refinancing or for Reorganizations of large Industrial Concerns or for outright Purchase of large going Concerns.

No Promotions

ASSOCIATED STEEL CORPORATION
527 5TH AVENUE, N. Y. C.

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

EMPLOYMENT. . .
EQUIPMENT. . .
BUSINESS
OPPORTUNITIES
Whatever your need—
think "SEARCHLIGHT" FIRST

WANTED

SALES MANAGER

by

Machine Tool Builder with well-known, medium size organization, designing and building special and standard machinery, firmly established for many years, location Detroit. Excellent opportunity for a permanent position.

SW-375, American Machinist
520 No. Michigan Ave., Chicago, Ill.

SALESMAN WANTED

There is an opening in a few selected territories for an experienced salesman who has successfully sold services or intangibles. Technical experience not necessary. An American Citizen, between the ages 35 and 55, preferably married, who is able to meet and contact key executives in industry. Field training will be given the successful applicant and earnings should be $4,000 a year—the average of our present salesmen. One acquainted with the field served by this publication will find this connection a pleasant and profitable one. Our organization is an old, well-known concern with an excellent reputation. To learn more about this opportunity write full details to Box

SW-377, American Machinist
330 W. 42nd St., New York City

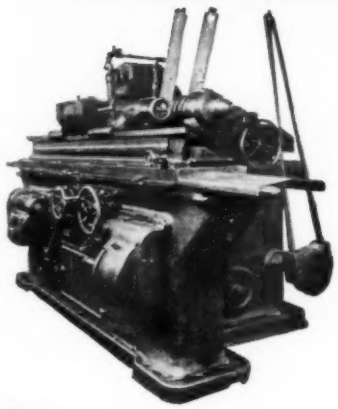
Professional Services

COLUMBIA ENGINEERING CORP.
STRUCTURAL, MECHANICAL & ELECTRICAL ENGINEERS
War Plant Design - Supervision of Construction - Engineering Reports

61 Broadway, New York, N. Y.
323 Plum Street, Cincinnati, Ohio

When You Need Machine Tools Check "FALK'S" Stock

"FALK" for DEPENDABILITY in Rebuilt Machinery



GRINDERS

Gorton, double end disc grinder, 18" discs
#51 Oliver drill grinder, M. D.
Sellers drill grinder
#1 Le Blond tool and cutter grinder

COMPRESSORS

Gardner, 4½ x 4½, duplex
Bury, 8 x 8
Curtis, Verticle, duplex, 8 x 8

BRAKES

Dreiss & Crump 8' x 14 gauge
Dreiss & Crump hand brake, 8' x 18 gauge

GEAR CUTTER

Gould & Eberhard, 36" arranged motor drive

RADIAL DRILLS

2—Niles, Bement-Pond, flat column 5' arm
Niles Bement Pond, flat column 6' arm

RIVETING MACHINES

#4A Grant riveting hammer, 5/16" capacity

DROP HAMMERS

2—Standard Automatic, 100 lbs.
Standard Automatic Belt drop hammer, 200 lbs.

TURRET LATHES

#4 Warner & Swasey, 1½" capacity.
#6 Warner & Swasey, 2¼" capacity
21" x 3¾" Hole—Gisholt Universal

SAWS

Hunter friction Saw, motor driven, 16" blade
Peerless, saw size 10x10
Racine Saw size 9x9

THREAD ROLLERS

2—#10 Waterbury & Farrell thread rollers
2—#0 Waterbury & Farrell thread rollers
2—#30 Waterbury & Farrell thread rollers
2—#22 Waterbury & Farrell cold headless & double Stroke solid die
#33 Waterbury & Farrell cold headers & double stroke solid die

TRIMMERS

2—Waterbury—Farrell Automatic Trimmers ⅝ cap.

MILLERS

#1 Le Blond Universal Miller
Sanford production Miller
#7 Becker production Miller
Pratt & Whitney Duplex miller
Hall planetory thread miller
Lees Bradner thread miller, 54"
Taylor & Fenn Verticle milling #7 B&S taper
2—Type A Gooley & Edland production millers, m.d.
Cincinnati #3 high power, cone drive, flange nose

PRESSES

#3 Niagara 1½" stroke
#3 Baxendale, 2" stroke
#2 Baxendale 1½" stroke
#16 Niagara horn press, geared, M.D.
#44 V. & O. horn press geared, M. D.
#62 Bliss reducing press, Henry & Wright press, 25 ton, General Fixible press, 3 ton
#65½ Consolidated punch press, straight side

SHEARS

Pexto foot shears, size 36" x 16 gauge
156" Hyde Park, ⅜ cap. 18" gap, M.D.
156 "Mesta ½" cap., 15" gap motor drive

THREADERS

14—Chicago automobile Venticle threader 2 spindle

LATHE

McCabe Geared head lathe 40" swing 18' bed 18 speeds, direct motor drive 3/60/220
18 x 10' Rahn Larmon plain change geared lathe
10" x 24" New Logan lathes, with collets, etc.

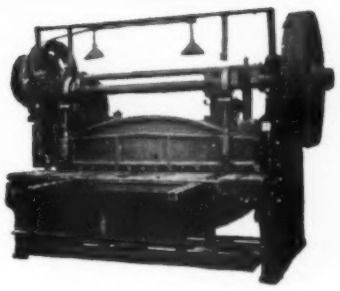


PLATE SHEARS

156" Mesta Eng. Co. ½ cap. 15 gap, M.D.
#262 Niagara, 60", 14 gauge, arranged motor drive

PRESSES

No. 4 Bliss, double Crank, geared forging press.
2—No. 4½ Bliss double crank geared forging press
2—No. 4½ S Bliss, three column, geared forging press with Taper rolls
No. 5—Bliss, double crank, geared forging press press
48" Wickes Bros. double end punch and shear 1¼ thru 1¾ cap. motor drive

TAPPERS

#2 Garvin Tapper

UPSETTERS

Acme upsetter 1" cap.
Acme upsetter 1½" cap.

BORING MILLS

62" American, heavy duty, verticle boring mill 2 swivel heads, self contained belt drive Friction feed
Friction feed
#1 Barrett Horizontal boring and facing mill 3⅞" bar, with facing head.

DRILLS

3—Barnes drill 20" cap. #3 Morse Taper
3—Buffalo Forge drill 20" cap. #3 Morse Taper
Avey drill, two spindle #2 Morse taper
Avey drill three spindle size ½
Cincinnati 24" upright heavy duty

MISCELLANEOUS

Abbott burnishing barrel 8" x 36"
Degreaser size 48" x 21" x 20"
Torrington Slitter, for tin plate, 3 sets of cutters
Blakeslee metal washer

We try to maintain one of the leading stocks of Used Machinery.

SEND US YOUR INQUIRIES—EVERY ITEM FULLY GUARANTEED.

FALK MACHINERY COMPANY

MACHINERY MERCHANTS

18 WARD ST., ROCHESTER, N.Y.

AUTOMATICS

14"x19" Fay
No. 6A Potter & Johnston
Nos. 33, 34 and 454 New Britain
4½" Gridley model H
6"x6¾" Goss & DeLeeuw
1" Cleveland "J" double end
No. 16 Gisholt simplimatics
10" Bullard "Vert-au-Matic"

BROACHES

Nos. 1, 3 and 4 LaPoint screw
No. 3 LaPoint double screw
No. 2 Standard screw press
2 ton American rack vertical

DRILLS

15", 20", 21" Buffalo
20", 22½" and 26" Barnes
21" and 25" Superior
20", No. 210 Barnes heavy
24" Barnes all geared
20" No. 23 Foote Burt
21" Cincinnati manufacturing
Natco multiple Nos. 11, 12, B12, C12, 14 and 32, 8 to 62 spindles
No. 1 Baush multiple
No. 13 Pratt & Whitney multiple
Nos. 15½D and 15½F Foote Burt manufacturing
No. 8H Natco hydraulic horizontal multiple
Barnes vert. mult. hydr.
8 spindle No. 6 Moline Holehog
Nos. 0 and 00 Garvin duplex
4"x10" Sundstrand centerer
4' Hammond radial
Sensitive drills. Almost all makes and sizes

FORGING & STRUCTURAL

1½" Acme upsetters
2½" and 4" Ajax upsetters
3" National upsetter
No. 1A Ajax forging rolls
No. 4 Torrington swager
No. 6HS Langeller swager
60 lb. Bradley helve hammer
150 lb. Nazel air hammer
No. 1 Rock River bulldozer
No. 29 Williams White bulldozer
12", 1½"x1" Cleveland horizontal punch
12", 1¼"x1" Long & Alstatter punch
26", ¾"x¾" Rock River punch

GEAR MACHINERY

Nos. 3 & 12 Barber Colman
No. 18 H Gould & Eberhardt
Nos. 1 & 5A Lees Bradner
26"x48" Brown & Sharpe automatic
30" Flather automatic
36" Gould & Eberhardt automatic
60" Cincinnati automatic
Nos. 6, 61 & 62 Fellows shapers
18" Gleason testers & lappers
15" Gleason spiral gear rougers
Gleason spiral pinion rougher
18" Gleason bevel generator
2 spindle Lipe chamferer
Pratt & Whitney worm grinder
National gear checker

GRINDERS

10x36 x 10x50 Norton
12x36 Landis
12x36 Cincinnati
Capitol internal
Nos. 6 & 15A Bryant internal
12"x36" Diamond surface
20"x50" Safety surface
Nos. 50 & 60 Heald cylinder
18", 24" & 53" Gardner disc
24", No. 84 Gardner opposed disc
17"x36"-48" Norton hydraulic crankshaft
Gisholt tool grinder
24" Ingersoll tub type
30" Ransom elect. snagging
16" Norton snagging
1¼" Wil. & Morman drill
type 15 Norton lapper
No. 575 Hawes tub polisher
20" & 36 Wet Tool

LATHES, TURRET

28" Steinle, 8" hole
24" Steinle 6¼" hole
22" Steinle, 3-9/16" hole
22" Libby, 4½" hole
2¼x24 & 3"x36" Jones & Lamson
Double spindle Jones & Lamson
14"x6' Lodge & Shipley with turret
No. 2 Acme
No. 2 Southworth
No. 2 Warner & Swasey

LATHES, MFG.

11"x3' South Bend, OCG
13"x20" Seneca Falls "Short Cut"
13"x6' Automatic threading
20"x8'6" Wickes mfg.
Melling camshaft
Melling crankshaft
28"x9' centers Bridgeford axle
3½"36" Lo Swing

MILLS, BORING

3⅞" bar Beeman & Smith horiz.
4-15/16" bar Barrett cylinder boring
36" Niles vert. car wheel borer

MILLING MACHINES

No. 3 Turnmilling for round work
Nos. 1 & 1A Davis & Thompson drum type duplex
48" Oesterlein tilted offset
Nos. 10 & 45 Productomatic
No. 6 Whitney hand
12" Pratt & Whitney automatic
Model AB Becker vertical

PLANERS & SHAPERS

24"x24"x5' Gray
24"x24"x6' Woodward & Powell
29"x29"x6' New Haven
36" Morton draw cut shaper
12" Dill vert. shaper or slotter

PRESSES

No. 5 Bliss Consolidated OBI
No. 5½ Niagara OBI
Nos. P2 & PA3 Ferracute
Nos. 14½ & 41A Toledo horning
Nos. 6 & 6½ Wat. Ferrel gap
No. 76 Toledo gap frame
No. 62 Bliss gap frame
No. 38½ Bliss straight side
No. 53 Toledo straight side
No. 8-7 Zeh & Hahnemann S.S.
No. 7 Rockford straight side
No. 4 Massillion straight side
No. 2 Standard screw type
28", No. 71 Swaine dbl. cr.
No. 6A Bliss cam drawing
No. 180 Toledo toggle drawing
No. 796¼ Toledo double crank toggle drawing, 198" bet. upr.
750 ton Baldwin Southwark triple action hydraulic toggle, 142½" between uprights

RIVETERS

Nos. 3A, 4A, 5½B & 7B High Speed
No. 80 Grant
20 ton Allen pneumatic

SHEET METAL TOOLS

4'x3/16" Cincinnati press brake
12'x10 ga. Ohl press brake
4'x3/16" Bay City band roll
No. 352 Toledo band roll
Nos. 1 & 2M Pettingell hammers
¾"x3' and 5' Shuster wire straightener & cutter
Sleeper & Hartley casing coiler
No. 5 Sleeper & Hartley spring coiler
No. 3 RH Magee Wirer

SHEARS

No. O-15 Stanley Uni-Shear
No. 225 A Bliss slitter
18" Pels beam
2" Newbold guillotine
1½" Lewis alligator
2" Hilles & Jones alligator

TAPPERS

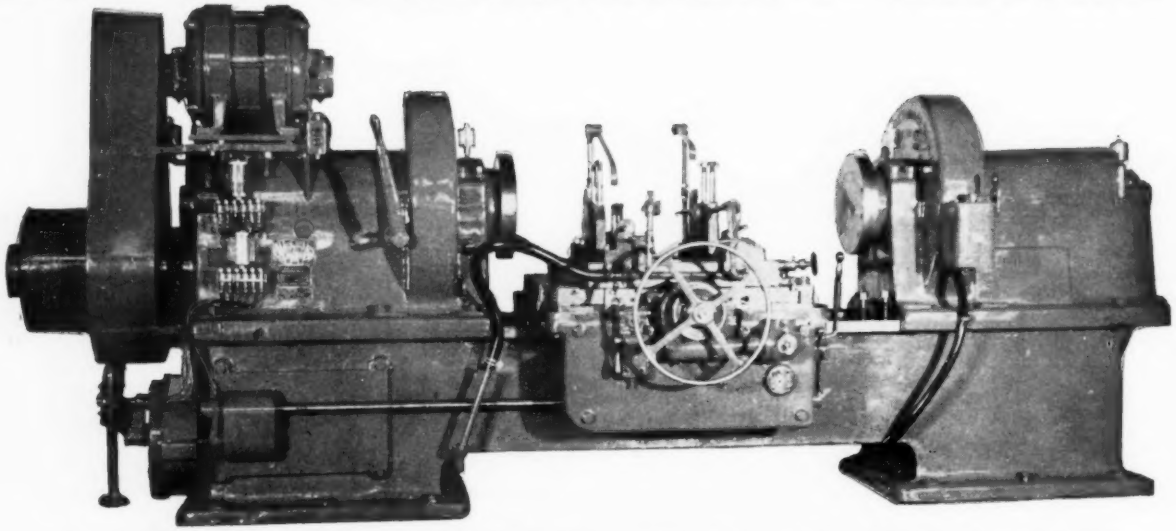
¾" National precision nut
Nos. 1 & 2X Garvin
Natco lead screw, 1 & 2 way
1½" National 6 spindle nut

THREADERS

½"x3" Wat. Farrel thread roller
½" Acme double head
¾" Economy
1½" Geometric
2" Landis double
2" Landis pipe & Nipple
2" Rogaco pipe mach.

MILES MACHINERY COMPANY, Saginaw, Mich.

DUPLEX CRANKSHAFT LATHES



34" Wickes Semi-Automatic Duplex Type Crankshaft Lathes

Swing over bed 34".
Swing over cross slide 20".
Takes between face plates 3' 10".
Capacity of crankshaft 8" stroke x 5 ft. to 6 ft. overall.

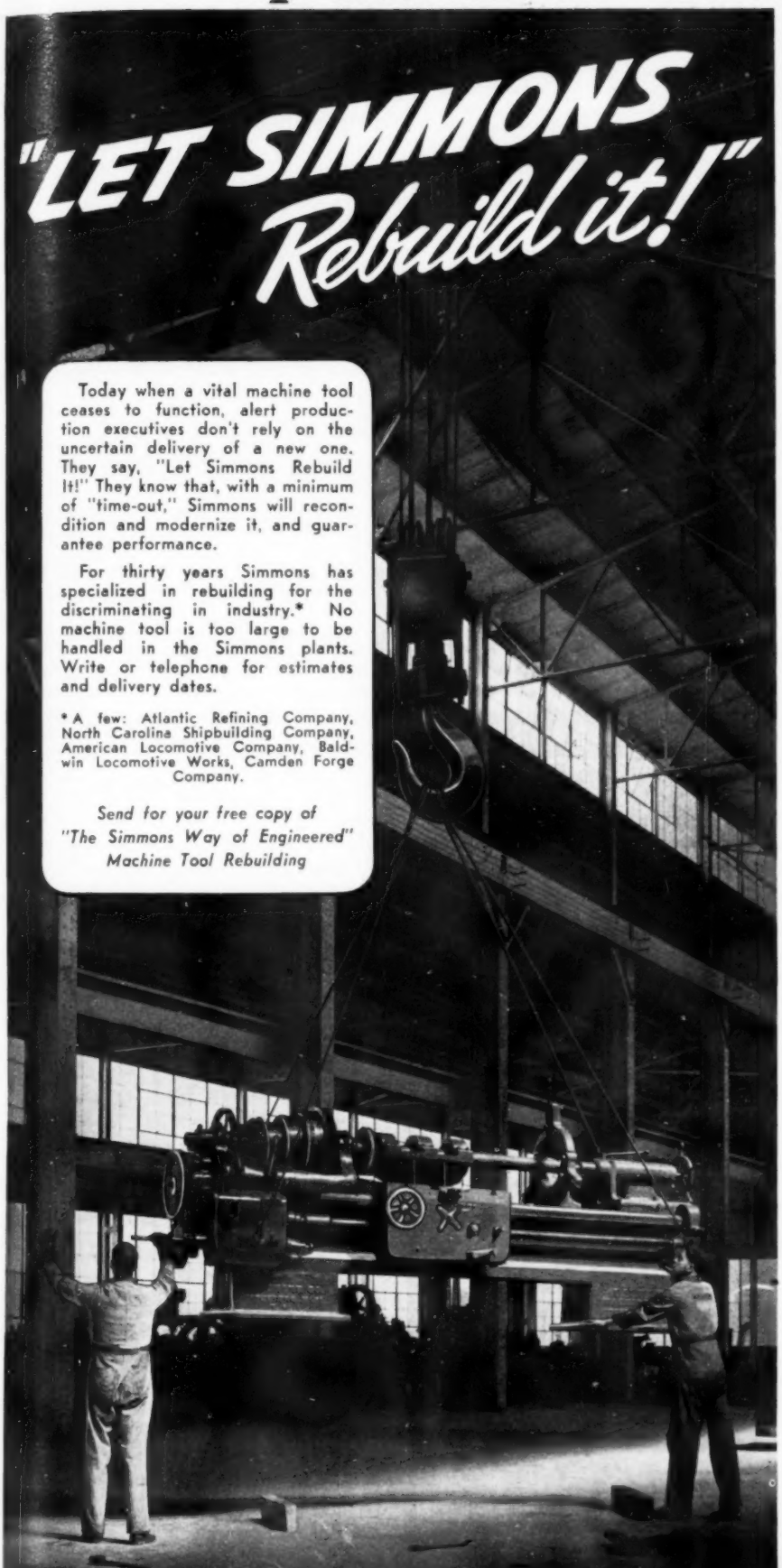
Designed for machining one pair of pins at one time and for machining two or more line bearings at a time. These machines may also be used for any heavy turning operations.

Available for inspection at our Chicago warehouses

LOUIS E. EMERMAN & CO.

CHICAGO, ILLINOIS

"LET SIMMONS Rebuild it!"



Today when a vital machine tool ceases to function, alert production executives don't rely on the uncertain delivery of a new one. They say, "Let Simmons Rebuild It!" They know that, with a minimum of "time-out," Simmons will recondition and modernize it, and guarantee performance.

For thirty years Simmons has specialized in rebuilding for the discriminating in industry.* No machine tool is too large to be handled in the Simmons plants. Write or telephone for estimates and delivery dates.

*A few: Atlantic Refining Company, North Carolina Shipbuilding Company, American Locomotive Company, Baldwin Locomotive Works, Camden Forge Company.

Send for your free copy of "The Simmons Way of Engineered" Machine Tool Rebuilding

Awarded to the employees of the Simmons Machine Tool Corp. for excellence in production.

IN STOCK

Every machine listed in this column is in our warehouse at press time.

RAILROAD SHOP TOOLS

48" PUTNAM CAR WHEEL BORING, Motor Drive through Gear Box, Hub Facing Attachment

52" BETTS CAR WHEEL BORING, Five-Jaw Chuck, Pneumatic Hoist, All Geared Feeds, M.D.

5' POND RADIAL DRILL, Flat-Column, Belted Motor Drive, No. 5 Taper

DOUBLE AXLE LATHE N.B.P. No. 2, 12" Opening in head, 96" centers

JOURNAL TRUING LATHE BRIDGEFORD, 27" swing, 45" through Gap, 8' 9" centers

42" PUTNAM CAR WHEEL LATHE, Power Rapid Traverse to tailstock, Overhead Air Hoist, M.D.

48" N.B.P. CAR WHEEL LATHE, Power Rapid Traverse to R. H. Headstock, Air Clamp Tool Blocks, M.D.

80" N. B. P. DRIVING WHEEL LATHE, Adjustable Speed 230 V. D.C. Motor and Control, P.R.T. to R.H. Headstock

60" NEWTON PORTABLE SLOTTER, Swivel Clapper Box, Angular Feed 230 V. D.C. Rev. Motor Drive

SIMMONS ENGINEERED Machine Tool REBUILDING

SIMMONS MACHINE TOOL CORP.
1759 NORTH BROADWAY, ALBANY, N. Y.
NEW YORK OFFICE: 149 BROADWAY

REBUILT MEANS ALREADY-BUILT

Partial Listing of Items In Stock Subject to Prior Sale

MACHINE TOOLS

DRILLS—5' Bickford Radial, 13" column, mtr. drive.

4 spindle Leland-Gifford B. B. Sensitive, #2 taper, tapping attachment.

GRINDERS—#1 Gardner Face Grinder, 7½ H P mtr. table 10"x30".

LATHES—42"x20' H. S. & G., belt drive, quick change, not screw cutting.

26"-48"x16' McCabe, double spindle, belt drive, 10' centers.

24"x10' National 8 speed, geared head, quick change, pan bed.

18"x14' Hamilton, belt drive, quick change.

16"-23"x8' South Bend Gap Lathe, belt drive.

16"x8' Hendey, belt drive, quick change, taper attachment.

14"x10' Walcott, belt drive, quick change, taper attachment.

MILLERS—(2) #3 Brown & Sharpe, all geared head, vertical, table 66"x 16½" and 50"x16½", mtr. dr.

Hendey "Lincoln" type Production Miller, table 9"x30", belt drive.

PLANERS—60"x60"x12' L. Pond, belt drive, 2 heads on rail.

24"x24"x6' Putnam, belt drive, 1 head.

SHAPERS—24" Barker, single geared, belt drive.

20" Barker, back geared, belt drive.

21" Smith & Mills, back geared, belt drive.

SHEARS—6' Robinson Squaring Shear, 16 ga. cap., belt drive.

SLOTTER—10" Buckton, belt drive, 24" table, 23" throat, power feeds.

TURRETS—32" Bogart heavy duty, belt drive, 4" spindle, 28" chuck, hexagon turret.

#2 Foster arranged for bar work, 1⅛" cap., belt drive.

#1 Foster arranged for bar work, ¾" cap., belt drive.

WHEEL PRESSES—200 ton Caldwell, 38" between bars, motor drive, with pump.

We are also representatives in the Philadelphia area for many of the leading national manufacturers of new machinery

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

113 NORTH THIRD STREET • PHILADELPHIA - PENNA.

BELL TELEPHONE: MARKET 4180 CABLE ADDRESS OBRIEN-PHILA

S. & S. MACHINERY

For Dependability

LATHES

Hendy—12" x 5'. Q.C., M.D.
Porter Cable
Lodge & Shipley 14 x 8' M.D.
Porter 14 x 8' M.D.

TURRET LATHES

Jones & Lamson—3 x 36" M.D.
Gisholt—21"—2" through spindle.
Gisholt—5¾" through spindle.

GEAR CUTTERS

26" Brown & Sharpe.
36" Fellows.
G.E. 3 x 36" Spur.
G.E. 36".

AUTOMATICS

1—No. 53 National Acme
5—No. 55 National Acme M.D.
1—2¼" Gridley Single Spindle.
2—Gridleys Model G, ¾" Cap.

MILLERS

No. 3 Garvin Duplex
3—18" Cincinnati Production
1—12" B & S.
10—7 Becker Production.

GRINDERS

Modern—16" x 60" M.D.

SHAPERS

G & E 24" M.D.
G & E 10" M.D.

RADIAL DRILLS

4" Bickford.
Foote Burt Heavy Duty Drill.

BORING MILLS—HORIZONTAL

4" Single Pulley Driven Bickford.
2" Binsee.
40" Vertical Bickford.

MISCELLANEOUS

American Planer—36" x 36" x 8' 2 Heads on rail M.D.
10" Geo. A. Ohl Power Shear 14 gauge.
36" Throat Heavy Duty Punch, M.D.
1000 lb. Chambersburg Steam or Air Hammer, Single Frame.
10" and 12" Slotters, Newton.
16" Beasley Ball Bearing Grinder.
3—Form Rolling Machines (5 sets of Form Rollers).
1—Heller Motor Driven Cold Saw with 24" Blades and 1 Machine to grind saws for same.
Thompson Spot Welder—50 KVA Air Operated.

COMPLETE MACHINE SHOP

AVAILABLE IMMEDIATELY

PATCH OPEN SIDE PLANER, M.D. 48 x 48 x 13'. In excellent condition. Cord Box Table.

AMERICAN LATHE, 26" x 18' Q.C. D.B.G.

SCHUMACKER & BOYE LATHE, 26" x 12'. L.C. Taper Attachment.

SIDNEY LATHE, 17" x 8'. Q.C. D.B.G. Taper Attachment.

SOUTH BEND LATHE, 16" x 10'. Q.C. Taper Attachment. CAP.

CHAMPION LATHE, 16" x 8'. Q.C.

LATHE, PLAIN CHANGE GEAR, 16" x 6'.

DRILL PRESS, EBERHARDT, 24". Sliding Head.

CINCINNATI #2 PLAIN MILLER, with dividing head.

ROCKFORD SHAPER, 24".

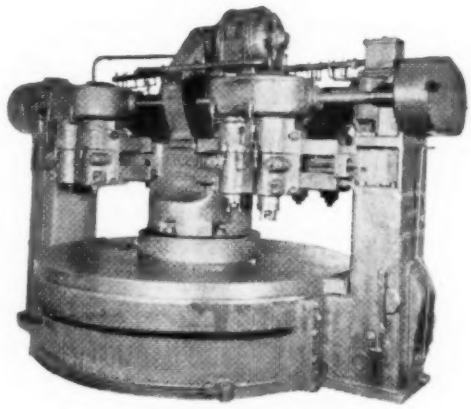
HYDRAULIC WHEEL PRESS, with pump. 150 tons.

G.E. ELECTRIC WELDER. 300 Amps.

"Send us your inquiries as well as a list of your surplus machinery"

207 CENTER STREET TEL. WORTH 4-5710 NEW YORK, N. Y.

NEWTON ROTARY MILL from stock



V-4 NEWTON CONTINUOUS MILL

Emerman offers this mill available for quick delivery from stock. This double station continuous miller is especially suited for large work such as milling tops and bottoms of cylinder blocks, cylinder head gasket surfaces, heavy motor frames and similar work.

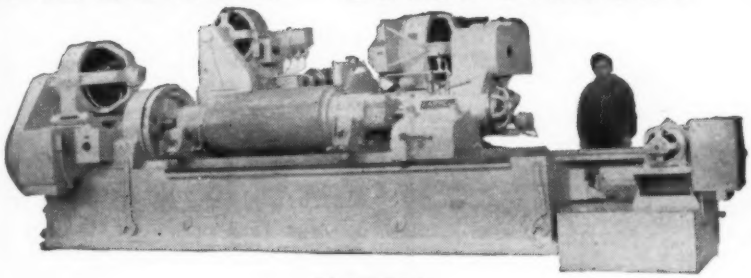
With 2 double heads on front of rail and 2 double heads on rear rail

Table diameter 106".
Table working width 33".
Horizontal adjustment of each head on rail 19".
Diameter of spindle sleeves 6⅝.
Vertical adjustment of each spindle 4".
Maximum distance between front and rear heads 42".
Maximum distance from spindle to face of table 21⅝".
Arranged for motor drive.

LOUIS E. EMERMAN & CO.
machinery

875 W. 120th St. Chicago, Ill.

PROMPT SHIPMENT FROM STOCK



32" FARREL ROLL GRINDER

WILL GRIND ROLLS UP TO MAXIMUM OF 34" DIAMETER; 30" GRINDING WHEEL; 10'6" BETWEEN CENTERS; WITH MOTORS & CONTROLS;

GRINDERS

CYLINDRICAL: 14"x72" NORTON; P.F.; 10"x36" LANDIS; No. 22 LANDIS;
DISC: No. 24 GARDNER VERTICAL SPINDLE HORIZ., B.B.; 53 disc; B.D.;

PLANERS

30"x30"x10 FT. DUSTIN; 22"x20"x5 FT. POND;
OPENSIDE: 42"x36"x14 FT. NEW ALBANY;
44"x38"x15 FT. NEW ALBANY; M.D.;
42"x40"x13 Ft. & 42"x42"x14 FT. PATCH;
2—42"x45"x15 FT. BEDFORD;
42"x45"x15 FT. LINCOLN;

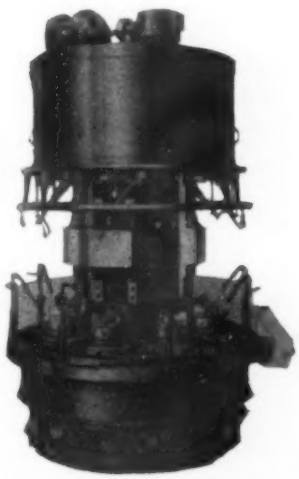
TURRET LATHES

No. 3A WARNER & SWASEY UNIVERSAL; Gd. Hd.; 3⅜" HOLE IN SPINDLE. P.F.; M.D.;
28" NILES BEMENT POND; 4¼" hole in spindle; P.F.; M.D.;
No. 1-L GISHOLT UNIVERSAL; Timken bearings; Hardened ways;

MISCELLANEOUS ITEMS

800# BLISS BOARD DROP HAMMERS;
NO. 3 PRATT & WHITNEY DIE SINKER;
No. E—3 KELLER DIE SINKER;
BILTON CAM MILLER;
NOS. 2-B & 3 MANVILLE THREAD ROLLERS;
SHUSTER WIRE STRAIGHTENERS; ½" & ⅝" capacities; 24 & 30 FT. cut-of's;
12" NEW HAVEN SLOTTER; 12¾" stroke;

6" BULLARD MULTI-AU-MATIC
4 Stations
Direct Motor Drive



INTERSTATE MACHINERY CO. Inc., Tel. Yards 5800
1439 W. PERSHING RD., CHICAGO, ILL.

EASTERN OFFERS FROM STOCK

BALL BEARING DRILLS
Sigourney Sensitive
1 spindle Allen
Automatic Sensitive
No. ¼ Avey
No. 2, 3 Avey
Henry & Wright Class K and L
Mason Bench Type
2 spindle Sigourney
3 spindle Barr
3 spindle Henry & Wright
4 spindle Fosdick 13" Super Speed
4 spindle No. 2 Fosdick, p.f.
4 spindle Gardam
4 spindle Henry & Wright
4 spindle Kokomo Superior
6 spindle Henry & Wright
2 spindle Barr

MULTIPLE SPINDLE DRILLS
3 spindle Rockford 12" Gang
5 spindle Detroit Horizontal
6 spindle National Acme Horizontal
No. 00S Garvon Horizontal Duplex
No. 1 Pratt & Whitney 2 spindle Gun Barrel
No. 1 Baush, 4 spindles
No. 1 Baush, 16 spindles
No. 2 Baush, hydraulic feed (3 in stock)
No. 2 Baush, mechanical feed
D2 Fox Straight Line
No. 3 Baush (3 in stock)
No. 7D Moline 2 spindle Cylinder Borer
D11 Fox, 11 spindles
No. 11 Pratt & Whitney
No. 22AC Fox, 6 spindles
No. 26C Fox Tapper, 54 spindles
No. 37 Natco, 18 spindles
No. 51C Harrington, 10 spindles

UPRIGHT DRILLS
10", 22" W. F. & John Barnes
12", 14" Mechanics
21" Champion
22", 24", 32" Aurora
22" Barnes All Geared Self-Oiling
24" Cincinnati
24" Hoefer
24" Milwaukee
25" Superior

GEAR CUTTERS & HOBBERS
No. 36H Gould & Eberhardt Gear Hobber
16" Gould & Eberhardt Cutter
18" Gleason Straight Bevel Generator
18" Gleason Bevel Gear Planer
No. 1—26" Whiton Full Universal Spur & Bevel
No. 3—26", 3—36", 3 Heavy, 4—36", 4—48", 6—60", 6—72" Brown & Sharpe Spur Gear Cutters
No. 5 Lees-Bradner Gear Generator
No. 3—26" Cincinnati Gear Cutter
No. 12 Barber-Colman Gear Hobbers
No. 615 Fellows Gear Shaper
Cross Gear Tooth Rounder
Gleason Spiral Bevel Gear Rougher
12" Ingle Gear Tooth Rounder

PLAIN CYLINDRICAL GRINDERS
10x36" Norton, 3 motor drive
10x36" Landis Integral Cam
10x52" Landis, m.d
10x72" Norton, 3 m.d.
12x36" Cincinnati, belt
12x36" Modern, m.d.
12x36" Modern, belt
12x42" Landis
12x48" Modern, m.d.
16x120" Landis, m.d.
26x96" Landis, m.d.

CYLINDER GRINDERS
No. 50 Heald, hydraulic feed (3)
No. 55 Heald, mechanical feed (3)
No. 60 Heald (2)
No. 65 Heald

VALVE SEAT GRINDER
Cincinnati Valve Seat Grinder, m.d., centerless type

INTERNAL GRINDERS
No. 10 Bryant, belt
No. 20 Bryant, belt

SURFACE GRINDERS
Walker Single Stroke, 10" rotary chuck
No. 1 Fraser Lapper, 26" plate
14" Pratt & Whitney Vertical, m.d. 10x34" chuck
38"x38"x12' Gray Planer Type Surface, m.d., 2 motors
54" Bridgeport Knife

TOOL & CUTTER GRINDERS
Gorton type 375-2, m.d.
Gisholt Universal, belt
Gleason Cutter, belt

Many other machines in stock.

Let us quote on your requirements.

The
EASTERN
MACHINERY CO.
1004 TENNESSEE AVE.
CINCINNATI, OHIO

LATHES
18" x 6' American Grd. Hd. 8 speed M.D. turret on shear Q.C.
16" x 8' Whitcomb Blaisdell Engine Lathe, 3 S.C.D. Q.C.
24" x 18' New Haven, Semi Q.C. Cone drive.
18" x 8' Cincinnati Lathe, 3 S.C.D. D.B.G. Q.C.
18" x 8' L & S Engine Lathe, Cone, Q.C.
40" x 20' McCabe Lathe, Cone Drive, Trip. Grd.
56" x 18' Putnam Turning Lathe, Belt feed.

GRINDERS
16" x 72" Landis Plain Grinder, Self contained.
Fitchburg Spline Shaft Grinder.
#55 Heald Cylinder.

MILLERS
#1 P & W Hand Miller.

GEAR MACHINERY
18" Gleason Bevel Gear Generators.
6" Bilgram Bevel Gear Generator.
18H Gould & Eberhardt Gear Hobber.
#1 Adams Gear Hobber.
#4—36" B & S Automatic Gear Cutter.
Lees Bradner Gear Grinder.

BORING MILLS
42" Colburn, Turret head and plain head.
5" Floor Type Boring Mill.

PLANERS
32" x 32" x 18' Gray Planer, 2 Heads.

MISCELLANEOUS
14" Niles Slotter.
1500# Bell Steam Hammer.

CINCINNATI MACHINERY & SUPPLY CO.
217 East Second St. Cincinnati, Ohio

BROACH, No. 2 LaPointe, M.D.
GEAR CUTTERS, Spur, 30", 36" & 40" M.D.
GEAR PLANERS, Bevel, 36" & 54" Gleason, M.D.
GRINDER, 18' x 30' x 96' Norton Cyl., M.D.
LATHE, Geared Head, 43"x23' N-B-P, M.D.
PRESS, Hydr., 1000 ton Wood, plates 42" x 9'.
SLOTTER, 15" Dill Table Dia. 34".
STRAIGHTENER, 12-roll Kane & Roach, M.D.

LANG MACHINERY COMPANY
28th St. & A.V.R.R. Pittsburgh, Pa.

Have your

used MACHINE TOOLS thoroughly REBUILT

in our *specially equipped* **14,000 sq. ft. factory**

Precision work • Prompt delivery

Free estimates

12"x5' Clausing Lathe (almost new), M.D.
14"x6' Flather Engine Lathe, quick change, M.D.
16"x10' Sidney Lathe, quick change, M.D.
20"x10' Lodge & Shipley, quick change, M.D.
22x10' Hamilton, geared head, M.D.
30"x12 Putnam Engine Lathe, quick change, M.D.
#4 Pedrick and Ayer Universal Milling Machine, M.D.
#4 National Plain Milling Machine, M.D.
#2 Osterlein Universal Milling Machine, M.D.
#25 Plain Becker Milling Machine, M.D.
#1 Becker Vertical Milling Machine, M.D.
42" Colburn Boring Mill, 2 Heads, M.D.
3"x36" Jones & Lamson Turret Lathe, M.D.
2¼x24 Jones & Lamson Turret Lathe.
#3 12"x28" Modern Universal Cylindrical Grinder, M.D.
23x52 Landis Cylindrical Grinder, M.D.
#2 O.S. Walker Tool & Cutter Grinder.
36"x36"x12' Woodward & Powel Planer, 3 Heads.
4' Prentice Radial Drill, M.D.
36" Putnam H.D. Drill Press, M.D.
#21 Bliss Press #0 Bliss Press.
2½ Stroke Niagara Press.

EAST RIVER MACHINERY CORP.
432 Bryant Ave., Bronx, N. Y.
Tel: DAyton 3-4246
City office: 1501 Broadway, New York
Tel: PEnnsylvania 6-4430

LATHES
No. 324 Adriance Spinning

MILLING MACHINES
2" Pratt & Whitney spline (duplex) (Double)
No. 1 Foote-Burt Surface Broach
New No. 3 Wigglesworth
No. 2 Knight Vertical

TURRET LATHE
Goss & De Leeuw Chucking, 6"x6½"

DRILLS
No. B16 Natco M.D.
No. B13 Natco M. D.
4 Spindle Taylor & Fenn M.D.

GEAR MACHINERY
6 Cimatool chamfering M.D.
Lees Bradner Gear Grinders (2)
9" Pratt Whitney Gear Grinder

MISCELLANEOUS
8" Bullard Multimatic M. D.
No. 1 Foote-Burt Duplex Surface Broach
21'x21"x5' Whitcomb Planer
24x24x8 Whitcomb Planer
36"x36"x8' Woodward & Powell Planer Rev. M.D.
No. 303 Bliss St. Side Gd. M.D.
2" Acme Belt Threader

WIGGLESWORTH MACHINERY CO.
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UNUSUAL VALUES

12"x6' Seneca Falls lathe, loose change gear.
3½"x50" Fitchburg Lo-Swing Lathe.
Turret, Lodge & Davis, Brass cross slide turret.
Brake: Robinson toggle 5'.
Drill Presses: 28", 24" Hoefer; 25", 20", 40" Bement.
Ceiling Suspended Drill Unlimited drilling area.
Grinders: #20 Bryant Internal.
60" Plate Grinders.
#60 Heald cylinder grinders.
Sellers Tool Grinder.
300 other machinery items.
Rock River ⅞" capacity punch and shear.
1—3-spindle 1" capacity Bolt Cutter.
1—2-spindle #0 Webster & Perks Threader.
Bolt Cutter 1¾ Acme with Landis Head.
Vacuum Cleaner, Invincible, shop size.
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Also rebuilt motors.

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Rockford Sgl. End Hydr. Boring Machine with 2-sta. 54" dia. table.
6' Niles Pl. Radial Drill
No. 60 NATCO 3-Way Multiple Drill
4-Spdl. Henry & Wright H.S. Drill
Niagara Dbl. Seamer, t.&l. pulley dr.
10x10" Napier Metal Band Saw
½" Shuster Auto. Cut.&Straight. Machine

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800# B&S Board Drop Hammer.
#14 Cochrane-Bly Vert. Miller & Shaper, M.D.
50" G & E Gear Cutter.
#55 Heald Internal Grinder.
10' Bridgeport Knife Grinder.
20"-24" G & E Shapers.
36" Morton Draw Cut Shaper.
No. 2 Baker Keyseater, 2"x20".

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MULT-AU-MATIC, 12" Bullard, 6 hds.

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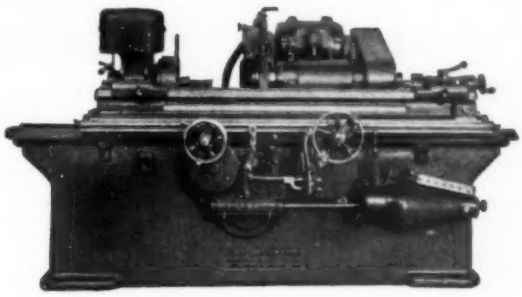

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. . . accurately fitted wheel slide with cross feed screw mounted on ball bearing.

. . . dynamically and statically balanced sheaves and motors.

. . . motor-driven coolant pump mounted on separate multiple compartment settling tank.

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10x50	14x50	16x72

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10-ft. Niles; 2 heads; M.D.

FROG AND SWITCH PLANER

36"x16"x20' Putnam; M.D.

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Single Spindle Colburn Heavy Duty Drill.

GEAR CUTTER

60"x12" Gould & Eberhardt; M.D.

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No. 3 Davis Thomp. Rot. M.D.

PIPE MACHINES

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1⅜", 1¾", 2¼" Gridley 4 spindle
1", 2¼" Nat.-Acme 4 spindle
3¼", 4¼" Gridley sgle. spindle

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AUTOMATICS, Cleveland ⅞" Model M, 4 spdle.

AUTOMATICS, #22, 23 & 24 New Britain

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60" x 17' Putnam Lathe with 12" Riser Blocks, total swing 85" M.D.

LATHE, 3x36" J.&L. Dble. Spdle.

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PLANERS, Bedford & Patch, 36"x13' Open Side with 1 Rail & 1 Side Head

PRESSES, Bliss Cleveland #152C D.C. 4" shaft, 5" stroke, 42x30" Bd., M.D.

PRESSES, Toledo, #34 Solid Back, S.G.

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48"x12' Harrington Gap, sld. bed
26"x13' Boye & Emmes
26"x14' Rahn-Larmon raising blocks to 34"
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1—Cincinnati #1½ Universal Tool & Cutter Grinder
1—Landis 16x52 Self-Contained Grinder—M.D.
1—Gardner #1 Disc Grinder Ball Bearing, Univ. tbl.

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5—Pratt & Whitney 5" Geared Automatic Millers—Receding type tables—like new—M.D.
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1—Brown & Sharpe #12 Manufacturing Miller. Working surface of table 29x6", 3⅜" overarm.

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1—Ingersoll Rand XS-2 No. 10 10x6½x10 Air Compressor.
1—Sullivan Horizontal WJ-3, 14x8¾x10 Air Compressor.

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1—Fosdick Machine Tool Co. 5' M.D. Full Univ. Radial Drill.

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1—Bradley 80-lb. Bradley Rubber Cushioned Helve Hammer.
1—Bell 600-lb. Steam Hammer—Hammer Base.

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1—Bardons & Oliver #7 Friction Head Power Feed Lathe—2" hole in spindle.
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1—8"x132" Lo-Swing Lathe—Steel ways—2 carriages.
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1—Flather 20"x12' LCG Lathe.
1—Prentice 18"x20' LCG Lathe.
1—Niles 22x12 LCG Lathe.
1—Johnson 30x24 Triple Geared Lathe.
1—New Haven 24—36x15 LCG Lathe, on risers, Hollow Spindle.
1—Bridgeford 26"x12' H.D. M.D. Dbl. Back Geared QCG Eng. Lathe.
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1—Bradford 14"x6' Tool Room Lathe, Q.C.G., motor drive, draw bar and collets.
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Complete Blueprinting Machine

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One head on rail, arr. for double tool-blocks.
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(See page 227, Hill-Clarke Cylindrical grinders)

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No. 10 Lees-Bradner Spur Gear Grinder 1½" dia. New Yankee Drill Grinder

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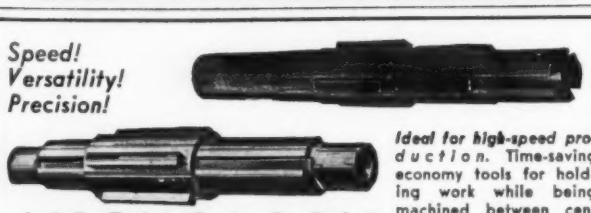

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Latrobe Electric Steel Co., Latrobe, Pa.
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National Twist Drill & Tool Co., Detroit
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pratt & Whitney Div., Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth, Mich.
Warner & Swasey Co., Cleveland

ATTACHMENTS, Broaching Machine
Colonial Broach Co., Detroit

ATTACHMENTS, Grinding Machine
Abrasive Mach. Tool Co., E. Providence, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Detroit Universal Duplicator Co., Detroit
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Landis Tool Co., Waynesboro, Pa.
Liberty Tool & Gage Wks., Providence, R. I.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.
Weldon Tool Co., Cleveland

ATTACHMENTS, Lathe
American Tool Works Co., Cincinnati
Ames Co., B. C., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Cincinnati Lathe & Tool Co., Cincinnati
Detroit Universal Duplicator Co., Detroit
Dumore Co., Racine, Wis.
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Hendey Machine Co., Torrington, Conn.
Jefferson Mach. Tool Co., Cincinnati
LeBlond Mach. Tool Co., R. K., Cincinnati
McCrosky Tool Corp., Meadville, Pa.
Monarch Machine Tool Co., Sidney, O.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Rockford Mach. Tool Co., Rockford, Ill.
South Bend Lathe Wks. So. Bend, Ind.
Strand Co., N. A. Chicago
Warner & Swasey Co., Cleveland

ATTACHMENTS, Milling
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Lathe & Tool Co., Cincinnati
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Detroit Universal Duplicator Co., Detroit
Fray Machine Tool Co., Glendale, Calif.
Jefferson Mach. Tool Co., Cincinnati
Lempco Products, Inc., Bedford, O.
Kearney & Trecker Corp., Milwaukee
Kempsmith Machine Co., Milwaukee
National Machine Tool Co., Cincinnati
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Machine Tool Co., Springfield, Mass.

ATTACHMENTS, Planer
Cincinnati Planer Co., Cincinnati
Sellers & Co., Inc., Wm., Philadelphia

ATTACHMENTS, Screw-Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Empire Tool Co., Detroit
Meisel Press Mfg. Co., Boston

ATTACHMENTS, Tapping
Avey Drilling Mach. Co., Cincinnati
Barber-Colman Co., Rockford, Ill.
Errington Mech. Lab., Stapleton, N. Y.
Greenlee Bros. & Co., Rockford, Ill.
Haskins Co., R. G., Chicago
Kingsbury Mach. Tool Corp., Keene, N. H.
Moline Tool Co., Moline, Ill.
Murchey Machine & Tool Co., Detroit
National Auto. Tool Co., Richmond, Ind.

BABBITT (See METALS, Bearing)

BALANCING MACHINES
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BALLS, Brass, Bronze & Steel
Federal Bearings Co., Poughkeepsie, N. Y.
S.K.F. Industries, Inc., Philadelphia

WHERE-TO-BUY DIRECTORY

Waterbury Steel Ball Co., Poughkeepsie, N. Y.

BARRELS, Tumbling & Burnishing
Waterbury Steel Ball Co., Poughkeepsie, N. Y.

BARS, Boring
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit
Elmes Engrg. Wks., Chas. F., Chicago
Fray Machine Tool Co., Glendale, Cal.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Lucas Machine Tool Co., Cleveland
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Boring Mach. Co., Hudson, Mass.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

BARS, Sine
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BATHS, Heat Treating & Annealing
Houghton & Co., E. F., Philadelphia

BEARINGS & BUSHINGS
Aluminum Co. of America, Pittsburgh
Bunting Brass & Bronze Co., Toledo, O.
Carlyle Johnson Machine Co., Manchester, Conn.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Babbitt
Bunting Brass & Bronze Co., Toledo, O.
Dodge Mfg. Corp., Mishawaka, Ind.

BEARINGS, Ball
Bantam Bearings Corp., So. Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Poughkeepsie, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S. K. F. Industries, Inc., Philadelphia
Schatz Mfg. Co., Poughkeepsie, N. Y.
Torrington Co., Torrington, Conn.

BEARINGS, Needle & Quill
Bantam Bearings Corp., So. Bend, Ind.
Federal Bearings Co., Poughkeepsie, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of Amer., Trenton, N. J.
S. K. F. Industries, Inc., Philadelphia
Torrington Co., Torrington, Conn.

BEARINGS, Non-Metallic
Bakelite Corp., N. Y. C.

BEARINGS, Oilless & Graphite
Bunting Brass & Bronze Co., Toledo, O.
Carlyle Johnson Machine Co., Manchester, Conn.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Roller
Bantam Bearings Corp., So. Bend, Ind.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of Amer., Trenton, N. J.
S. K. F. Industries, Inc., Philadelphia
Timken Roller Bearing Co., Canton, O.

BEARINGS, Thrust
(See preceding classifications)

BELLOWS, Seamless Metal
Chicago Metal Hose Corp., Maywood, Ill.

BELTING, Leather
Greene, Tweed & Co., N. Y. C.
Houghton & Co., E. F. Philadelphia

BELTING, Rubber & Fabric
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Col.

BELTS & BANDS, Abrasive
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Dumore Co., Racine, Wis.
Norton Company, Worcester, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Walls Sales Corp., N. Y. C.

BELTS "V"
Allis-Chalmers Mfg. Co., Milwaukee
Dayton Rubber Mfg. Co., Dayton, O.
Dodge Mfg. Corp., Mishawaka, Ind.
Gates Rubber Co., Denver, Col.

BENCHES, Shop
Baumbach Mfg. Co., E. A., Chicago
Delta Mfg. Co., Milwaukee
Hardinge Brothers, Inc., Elmira, N. Y.
Hill Acme Co., Cleveland
New Britain-Gridley Machine Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Boston
Standard Pressed Steel Co., Jenkintown, Pa.
Walker-Turner Co., Plainfield, N. J.

BENDERS, Hand
O'Neil-Irwin Mfg. Co., Minneapolis

BENDING & STRAIGHTENING MACHINES
Baldwin-Southwark Corp., Philadelphia
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Cleveland Punch & Shear Wks., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg. Works, Chas. F., Chicago
Farrel-Birmingham Co., Ansonia, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

BINS, Tool & Parts (See LOCKERS & SHELVING)

BITS, Tool
Allegheny-Ludlum Steel Corp., Pittsburgh
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carboloy Co., Detroit
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Crafts Co., Inc., Arthur A. Boston
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Latrobe Electric Steel Co., Latrobe, Pa.
McCrosky Tool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Union Twist Drill Co., Athol, Mass.
Vanadium Alloys Steel Co., Pittsburgh
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

BLADES, Circular-Saw (See SAW BLADES, Circular)

BLADES, Cutter, Milling, Boring & Reaming (See BITS, Tool)

BLADES, Hack- & Band-Saw
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C. Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Clemson Bros., Inc., Middletown, N. Y.
Continental Machines, Inc., Minneapolis
Disston & Sons, Inc., Henry, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Starrett Co., L. S., Athol, Mass.
Thompson & Sons Co., Henry G., New Haven, Conn.
Victor Saw Works, Middletown, N. Y.

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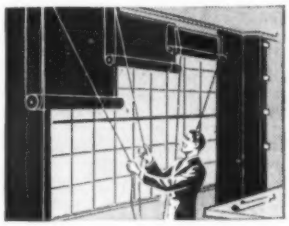
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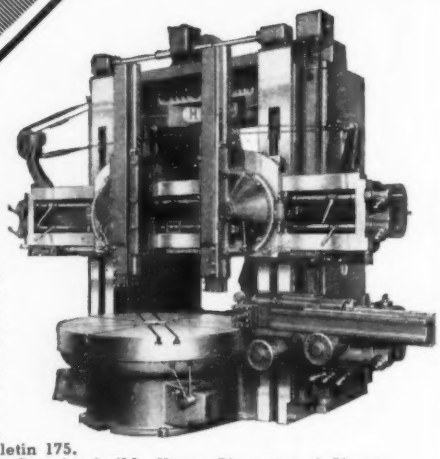

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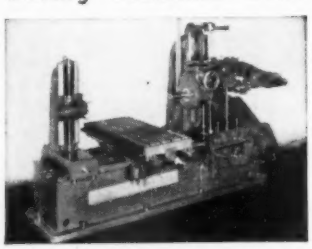

Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

WHERE-TO-BUY DIRECTORY

BLINDS, Black-out
Clopay Corp., Cincinnati.

BLOCKS, Pillow
Allis-Chalmers Mfg. Co., Milwaukee
Dodge Mfg. Corp., Mishawaka, Ind.
Earle Gear & Mach. Co., Philadelphia
Fafnir Bearing Co., New Britain, Conn.
Farrel-Birmingham Co., Ansonia, Conn.
Hill Acme Co., Cleveland
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S. K. F. Industries, Inc., Philadelphia
Standard Pressed Steel Co., Jenkintown, Pa.

BLOCKS, Precision Gage
Atometric Precision Gage Laboratories, Inc., Stamford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., Dearborn, Mich.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., Watertown, Mass.
Webber Gage Co., Cleveland

BLOCKS, "V"
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BLOWERS
Allis-Chalmers Mfg. Co., Milwaukee
American Gas Furn. Co., Elizabeth, N. J.
Buffalo Forge Co., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Wagner Electric Corp., St. Louis

BLOWERS, Electric Hand
Buffalo Forge Co., Buffalo, N. Y.
Skilsaw, Inc., Chicago

BLUEPRINT MACHINERY & ACCESSORIES
Wickes Brothers, Saginaw, Mich.

BLUING, Layout
Dykem Co., St. Louis

BOLT & NUT MACHINES
Cleveland Automatic Mach Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Consolidated Machine Tool Corp., Rochester, N. Y.
Eastern Machine Screw Corp., New Haven, Conn.
Federal Press Co., Elkhart, Ind.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haskins Co., R. G., Chicago
Hendey Machine Co., Torrington, Conn.
Hill Acme Co., Cleveland
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
New Britain-Gridley Machine Div., New Britain, Conn.
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Scherr Co., Geo., N. Y. C.
Taft-Peirce Mfg. Co., Woonsocket, R. I
W. & O. Press Co., Hudson, N. Y.

BOLTS, Eye & T-Slot
American Chain & Cable Co., Bridgeport Conn.
Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

BOLTS & NUTS
Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., Union, N. J.
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland
Rhode Island Tool Co., Providence, R. I.
Standard Pressed Steel Co., Jenkintown, Pa.

BORING, DRILLING & MILLING MACHINES, Horizontal
Atlantic Machinery Co., N. Y. C.
Avey Drilling Mach. Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bryant Machinery & Engrg. Co., Chicago
Buhr Mach. Tool Co., Ann Arbor, Mich.
Cincinnati Gilbert Mach. Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Defiance Mach. Wks., Inc., Defiance, Ohio
DeVlieg Machine Co., Ferndale, Mich.
Foote-Burt Co., Cleveland
General Machy. Corp., Hamilton, O.
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Greenlee Bros. & Co., Rockford, Ill.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Acme Co., Cleveland
National Auto Tool Co., Richmond, Ind.
Ohio Machine Tool Co., Kenton, O.
Sheffield Corp., Dayton, O.
Sellers & Co., Inc., Wm., Philadelphia
Snyder Tool & Engrg. Co., Detroit
Springfield Mach. Tool Co., Springfield, O.
Universal Boring Mach. Co., Hudson, Mass.
Yoder Co., Cleveland

BORING MACHINES, Jig (See JIG-BORING MACHINES)

BORING MACHINES, Precision
Barnes Co., W. F. & John, Rockford, Ill.
Bryant Machinery & Engrg. Co., Chicago
Ex-Cell-O Corp., Detroit
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Heald Machine Co., Worcester, Mass.
Leland-Gifford Co., Worcester, Mass.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Sheffield Corp., Dayton, O.
Stokerunit Corp., Milwaukee
Universal Boring Mach. Co., Hudson, Mass.

BORING MILLS, Vertical
Baush Mach. Tool Co., Springfield, Mass.
Bullard Co., Bridgeport, Conn.
Cincinnati Planer Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
King Machine Tool Co., Cincinnati
Sellers & Co., Inc., Wm. Philadelphia
Springfield Mach. Tool Co., Springfield, O.

BOXES, Tote
American Metal Works, Inc., Philadelphia, Pa.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

BRAKES, Bending, Power
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Wks. Co., Cleveland

BRAKES, Electric
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

BRICK, Furnace (See REFRACTORIES)

BROACHES
American Broach & Machine Co., Ann Arbor, Mich.
Butterfield & Co., Derby Line, Vt.
Colonial Broach Co., Detroit
Dalzen Tool & Mfg. Co., Detroit
Detroit Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
East Shore Mach. Pdts. Co., Cleveland
Ex-Cell-O Corp., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Lapointe Mach. Tool Co., Hudson, Mass.

WHERE-TO-BUY DIRECTORY

Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

BROACHING MACHINES
American Broach & Machine Co., Ann Arbor, Mich.
Cincinnati Milling Mach. Co., Cincinnati
Colonial Broach Co., Detroit
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg. Works, Chas. F., Chicago
Foote-Burt Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Thompson Grinder Co., Springfield, O.

BRONZE, Phosphor (See PHOSPHOR BRONZE)

BUFFERS & POLISHERS
Black & Decker Mfg. Co., Towson, Md.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Heald Machine Co., Worcester, Mass.
Hill-Acme Co., Cleveland
Jefferson Mach. Tool Co., Cincinnati
Landis Tool Co., Waynesboro, Pa.
Mattison Machine Works, Rockford, Ill.
New Britain-Gridley Mach. Co., New Britain, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland
Schauer Machine Co., Cincinnati
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Union Twist Drill Co., Athol, Mass.
Vonnegut Moulder Corp., Indianapolis
Walker-Turner Co., Plainfield, N. J.

BUFFERS & POLISHERS, Hand
Behr-Manning Corp., Troy, N. Y.
Roberts Rubber Co., Weldon, Newark, N. J.

BULLDOZERS
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Elmes Eng. Works, Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Watson-Stillman Co., Roselle, N. J.

BURNERS, Gas & Oil Furnace
American Gas Furn. Co., Elizabeth, N. J.
Hones, Inc., Charles A., Baldwin, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

BURNISHERS, Gear
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

BURNISHING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
Sheffield Corp., Dayton, O.

BURRING MACHINES
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Hill Acme Co., Cleveland
National Broach & Machine Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

BUSHINGS, Drill
Carboloy Co., Detroit
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Metal Carbides Corp., Youngstown, O.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS Steel (See LOCKERS & SHELVING)

CALIPERS & COMPASSES
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Ansonia, Conn.
Lufkin Rule Co., Saginaw, Mich.
Randall & Stickney, Waltham, Mass.
Scherr Co., Geo., N. Y. C.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS, Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Cross Gear & Machine Co., Detroit
Hartford Special Machinery Co., Hartford, Conn.
Weldon Tool Co., Cleveland

CARBURIZERS (See also BOXES, Heat-Treating & Annealing)
American Gas Furn. Co., Elizabeth, N. J
Houghton & Co., E. F., Philadelphia
Surface Combustion Corp., Toledo, O.

CARTRIDGE-CASE FINISHING MACHINES
Coulter Mach. Co., Jas., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

CASTINGS
American Brake Shoe & Fdry. Co., N. Y. C.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bunting Brass & Bronze Co., Toledo
Etna Machine Co., Toledo, O.
Hill Acme Co., Cleveland
Jefferson Mach. Tool Co., Cincinnati
Johnson Bronze Co., New Castle, Pa.
Mattison Machine Wks., Rockford, Ill.
Springfield Mach. Tool Co., Springfield, O.

CEMENT, Belt
Desmond-Stephan Mfg. Co., Urbana, O.
Houghton & Co., E. F., Philadelphia

CEMENT, Refractory
Carborundum Co., Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

CENTERING MACHINES
Consolidated Mach. Tool Corp., Rochester, N. Y.
Hanson-Whitney Machine Co., Hartford Conn.
Hendey Machine Co., Torrington, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Co., Rockford, Ill.

CENTERS, Bench
Brown & Sharpe Mfg. Co., Providence, R. I.

Characteristic of the design of all STURDIMATIC LIVE CENTERS is a low overhang and a slight cushioning action . . .
that compensates for expansion due to heat, shock and excessive thrust loads—reducing wear to a minimum. A properly engineered live center is one of the fundamentals of setting up a job and requires a specialist's experience . . . standard shanks with Morse taper carried in stock.

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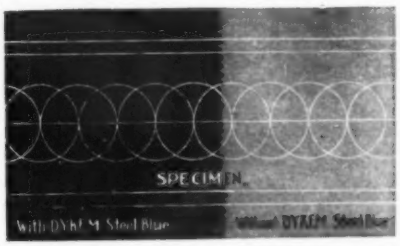
making dies & templates



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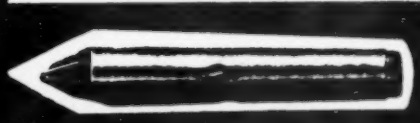

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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Providence, R. I.

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Abrasive Mach. Tool Co., E. Providence, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Company, Bridgeport, Conn.
Carboloy Co., Detroit
Cincinnati Lathe & Tool Co., Cincinnati (Lathe only)
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Firth-Sterling Steel Co., McKeesport, Pa.
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Hendey Machine Co., Torrington, Conn.
Knight Machinery Co., W. B., St. Louis
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney, Div. Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.

CENTRIFUGALS (See PURIFIERS, Oil & Coolant)

CENTRIFUGAL MACHINERY
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

CHAIN, Forged-Steel Link
American Chain & Cable Co., Bridgeport, Conn.

Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
McKay Co., Pittsburgh
Scully Steel Products Co., Chicago

CHAINS, Conveyor
Allis-Chalmers Mfg. Co., Milwaukee
American Chain & Cable Co., Bridgeport, Conn.

CHAINS, Transmission
Bilgram Gear & Mach. Wks., Philadelphia
Cincinnati Gear Co., Cincinnati
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland

CHAMFERING MACHINES
Bilgram Gear & Mach. Wks., Philadelphia
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Lipe-Rollway Corp., Syracuse, N. Y.
Murchey Machine & Tool Co., Detroit
National Broach & Mach. Co., Detroit
Sheffield Corp., Dayton, O.

CHECKS, Metal, Time and Tool
Acromark Co., Elizabeth, N. J.
Noble & Westbrook Mfg. Co., East Hartford, Conn.
Revere Copper & Brass Inc., N. Y. C.

CHISELS, Hand (See TOOLS, Hand)

CHISELS, Chipping, Pneumatic & Electric Hammer
Bethlehem Steel Co., Bethlehem, Pa.
Black & Decker Mfg. Co., Towson, Md.
Cleveland Pneumatic Tool Co., Cleveland
Plomb Tool Co., Los Angeles, Calif.
Scully-Jones & Co., Chicago

CHUCKING MACHINES (See also LATHES, Automatic & Semi-Automatic)
Bullard Co., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Gorton, Mach. Co., George, Racine, Wis.
Goss & deLeeuw Mach. Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Lees-Bradner Co., Cleveland
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland
Wickman Corp., Detroit

CHUCKS, Air (See CHUCKS, Pneumatic)

CHUCKS, Collet (See Collets)

CHUCKS, Drill & Tap
Atlas Press Co., Kalamazoo, Mich.
Errington Mech. Lab., Stapleton, N. Y.
Ettco Tool Co., Brooklyn, N. Y.
Gisholt Machine Co., Madison, Wis.
Horton & Son Co., E., Windsor Locks, Conn.
Jacobs Mfg. Co., Hartford, Conn.
McCrosky Tool Corp., Meadville, Pa.
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
North Bros., Mfg. Co., Philadelphia
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland

CHUCKS, Drill, Quick-Change, Collet
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Modern Tool Works, Rochester, N. Y.
Scully-Jones & Co., Chicago

CHUCKS, Gear
Cushman Chuck Co., Hartford, Conn.
Gleason Works, Rochester, N. Y.
Sheffield Corp., Dayton, O.

CHUCKS, Hydraulic
Cross Gear & Machine Co., Detroit
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
New Britain-Gridley Machine Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Lathe
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Cushman Chuck Co., Hartford, Conn.
Delta Mfg. Co., Milwaukee
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Harnischfeger Corp., Milwaukee
Hendey Machine Co., Torrington, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
L-W Chuck Co., Toledo, O.
McCrosky Tool Corp., Meadville, Pa.
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scherr Co., Geo., N. Y. C.
Tomkins-Johnson Co., Jackson, Mich.

CHUCKS, Magnetic
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Machine Co., Worcester, Mass.
L-W Chuck Co., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

CHUCKS, Motorized Electric
Cushman Chuck Co., Hartford, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland

CHUCKS, Pneumatic
Cushman Chuck Co., Hartford, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Ring-Wheel
Abrasive Mach. Tool Co., E. Providence, R. I.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Gardner Machine Co., Beloit, Wis.

CHUCKS, Spring
Brown & Sharpe Mfg. Co., Providence, R. I.
Harnischfeger Corp., Milwaukee
Rivett Lathe & Grinder, Inc., Boston

CLAMPS, Machinist's
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
North Bros. Mfg. Co., Philadelphia
Williams & Co., J. H., Buffalo, N. Y.

CLEANERS, Metal (See COMPOUNDS, Cleaning)

CLEANING EQUIPMENT (See METAL-CLEANING EQUIPMENT)

CLOTH, Abrasive (See PAPER & CLOTH, Abrasive)

CLUTCHES, Friction
Allis-Chalmers Mfg. Co., Milwaukee
Carlyle Johnson Machine Co., Manchester, Conn.
Dodge Mfg. Corp., Mishawaka, Ind.
Errington Mech. Lab., Stapleton, N. Y.
Foote Bros. Gear & Machine Co., Chicago
Hill Acme Co., Cleveland, O.
Lipe-Rollway Corp., Syracuse, N. Y.
Morse Chain Co., Ithaca, N. Y.
Reeves Pulley Co., Indianapolis

COLLARS, Safety
American Pulley Co., Philadelphia
Carlyle Johnson Machine Co., Manchester, Conn.
Dodge Mfg. Corp., Mishawaka, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLARS, Spacing
Atkins & Co., E. C., Indianapolis
Hill Acme Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford, Mass.
Scully-Jones & Co., Chicago
Standard Pressed Steel Co., Jenkintown, Pa.

COLLECTORS, Dust
Blake Co., Edward, Newton Centre, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Covel Mfg. Co., Benton Harbor, Mich.
Torit Mfg. Co., St. Paul, Minn.

COLLETS
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Brown & Sharpe Mfg. Co., Providence, R. I.
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Cincinnati Milling Mach. Co., Cincinnati
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Brothers, Inc., Elmira, N. Y.
Hendey Machine Co., Torrington, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland
National Auto, Tool Co., Richmond, Ind.
National Twist Drill & Mach. Co., Detroit
New Britain-Gridley Machine Co., New Britain, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed Prentice Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Stark Tool Co., Waltham, Mass.
Sundstrand Mach. Tool Co., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth, Mich.
Van Norman Mach. Tool Co., Springfield, Mass.
Warner & Swasey Co., Cleveland

COMPARATORS, Dial
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp, Dayton, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

COMPARATORS, Disc.
American Measuring Instruments Co., N. Y. C.

COMPARATORS, Gear-Tooth & Screw-Thread
Farrel-Birmingham Co., Buffalo, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Athol, Mass.

COMPARATORS, Optical
Jones & Lamson Mach. Co., Springfield, Vt.
Scherr Co., Inc., Geo., N. Y. C.
Vard, Inc, Pasadena, Calif.

COMPASSES, Metal-Scribing (See CALIPERS & COMPASSES)

COMPOUNDS, Cleaning
Bullard Co., Bridgeport, Conn.
Detroit Rex Products Co., Detroit
Houghton & Co., E. F., Philadelphia
Magnus Chemical Co., Garwood, N. J.
Oakite Products, N. Y. C.
Turco Products, Inc., Los Angeles

COMPOUNDS, Drawing, Metal & Wire
Houghton & Co., E. F. Philadelphia
Shell Oil Co., Inc., N. Y. C.

COMPOUNDS, Grinding & Polishing
Carborundum Co., Niagara Falls, N. Y.
National Broach & Machine Co., Detroit
Norton Co., Worcester, Mass.

COMPOUNDS, Plastic Molding
Bakelite Corp., N. Y. C.
Dow Chemical Co., Midland, Mich.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

COMPOUNDS, Tempering & Case-Hardening
Houghton & Co., E. F., Philadelphia
Oakite Products, Inc., N. Y. C.
Strong, Carlisle & Hammond Co., Cleveland
Stuart Oil Co., D. A., Chicago

COMPRESSORS, Air & Gas
Allis-Chalmers Mfg. Co., Milwaukee
American Gas Furn Co., Elizabeth, N. J.
Curtis Pneumatic Machry. Co., St. Louis
General Electric Co., Schenectady, N. Y.
Wright Mfg. Div. of Amer. Chain & Cable Co., York, Pa.

CONSULTANTS
Trundle Engrg. Co., Cleveland

CONTOUR MACHINES
Continental Machines, Inc., Minneapolis
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

CONTRACT WORK (See also Index, last page)
Aluminum Co. of America, Pittsburgh
American Cutter & Engineering Corp., Warren, Mich.
American Measuring Instruments Corp., N. Y. C.
Baldwin Southwark Corp., Philadelphia
Bayard & Co., M. L., Philadelphia
Chapman-Valve Mfg. Co., Boston (Heat Treating)
Continental Can Co., Inc., N. Y. C.
Eastern Machine Screw Corp., New Haven, Conn.
Elmes Engrg. Wks., Chas. F., Chicago
Ericson Screw Machine Prod. Inc., Brooklyn, N. Y.
Excello Corp., Detroit (Heat Treating)
Fenn Mfg. Co., Hartford, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Hartford Special Machy. Co., Hartford, Conn.
Hecker, A. W., Cleveland
Howard Foundry Co., Chicago
Jefferson Mach. Tool Co., Cincinnati, O.
Carlyle Johnson Machine Co., Manchester, Conn.
Kent-Owens Machine Co., Toledo, O.
Kropp Forge Co., Chicago, (Forgings)
Liberty Tool & Gage Wks., Providence, R. I. (Jigs & Fixtures)
Meisel Press Mfg. Co., Boston
National Acme Co., Cleveland
National Twist Drill & Tool Co., Detroit
New Britain-Gridley Machine Co., New Britain Conn. (Screw Machine Products)
Revere Copper & Brass, Inc., N. Y. C. (Forgings)
Rhode Island Tool Co., Providence, R. I. (Drop Forgings; Heat Treating; Screw Machine Products)
Stewart Iron Wks. Co., Inc., Cincinnati
Surface Combustion Corp., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Williams & Co., J. H., Buffalo, N. Y.
Woodworth Co., N. A., Ferndale, Mich.

CONTROLLERS, Motor
Allen-Bradley Co., Milwaukee
Allis-Chalmers Mfg. Co., Milwaukee
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland
Monitor Controller Co., Baltimore, Md.
Square D Co., Milwaukee
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

CONTROLLERS, Pressure & Temperature
American Gas Furn. Co., Elizabeth, N. J.
Brown Instrument Co., Philadelphia
Lindberg Engrg. Co., Chicago

CONTROLS, Flexible-Shaft (See SHAFTS, Flexible)

CONTROLS, Furnace
American Gas Furn. Co., Elizabeth, N. J.
Brown Instrument Co., Philadelphia
Lindberg Engrg. Co., Chicago
Strong, Carlisle & Hammond Mach. Co., Cleveland

CONTROLS, Hydraulic
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.

CONVEYORS
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Mathews Conveyor Co., Ellwood City, Pa.
Standard Conveyor Co., N. St. Paul Minn.

COOLANT SYSTEMS, Portable
Gray Mills Co., Chicago

COOLANTS, Cutting, Drilling & Grinding
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Gray-Mills Co., Chicago
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products, Inc., N. Y. C.
Shell Oil Co., Inc., N. Y. C.
Socony Vacuum Oil Co., Inc., N. Y. C.
Standard Oil Co. of Ind., Chicago
Stuart Oil Co., Ltd., D. A., Chicago
Sun Oil Co., Philadelphia
Swan-Finch Oil Corp., N. Y. C.
Tidewater Associated Oil Co., N. Y. C.

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Butterfield & Co., Derby Line, Vt.
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Cleveland Twist Drill Co., Cleveland
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Weldon Tool Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.

COUNTERSHAFTS
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Cincinnati Lathe & Tool Co., Cincinnati
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Earle Gear & Mach. Co., Philadelphia
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.
Hill Acme Co., Cleveland
LeBlond Mach. Tool Co., R. K., Cincinnati
Rivett Lathe & Grinder, Inc., Boston
Stow Mfg. Co., Binghamton, N. Y.
Warner & Swasey Co., Cleveland

COUNTERSINKS (See DRILLS, Twist)

COUNTERS, Revolution & Stroke
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

COUPLINGS, Hose
Cleveland Pneu. Tool Co., Cleveland
Schrader's Son, A., Brooklyn, N. Y.

COUPLINGS, Shaft, Flexible
Allis-Chalmers Mfg. Co., Milwaukee
Delta Mfg. Co., Milwaukee
Earle Gear & Mach Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Foote Bros. Gear & Mach. Co., Chicago
Hill Acme Co., Cleveland
Morse Chain Co., Ithaca, N. Y.
Nicholson & Co., W. H., Wilkes-Barre, Pa.

COUPLINGS, Shaft, Non-Flexible
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General Electric Co., Schenectady, N. Y.
Hill Acme Co., Cleveland
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Jib
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis Pneumatic Machy. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CRANES, Overhead Traveling
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis Pneumatic Machy. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CRANES, Portable
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CUSHIONS, Die
V. & O. Press Co., Hudson, N. Y.

CUTTERS, Angle
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
McCrosky Tool Co., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Mach. Co., New
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago

CUTTERS, Die-Sinking
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Gorton Machine Co., Geo., Racine, Wis.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.

CUTTERS, Formed
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Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
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Illinois Tool Works, Chicago
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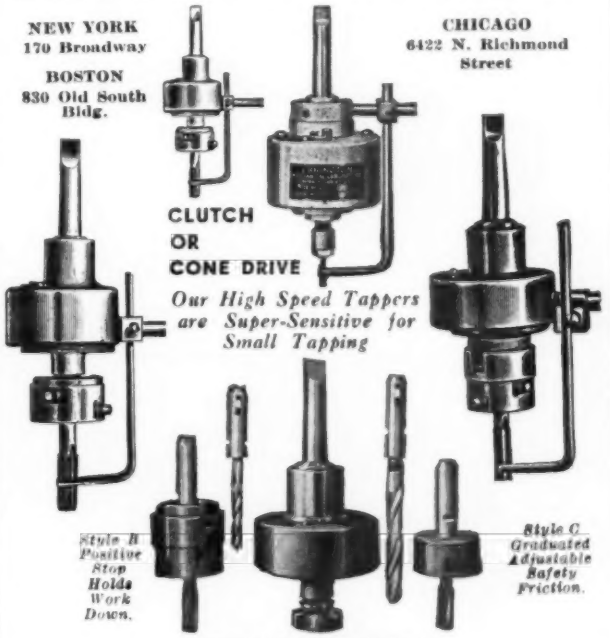

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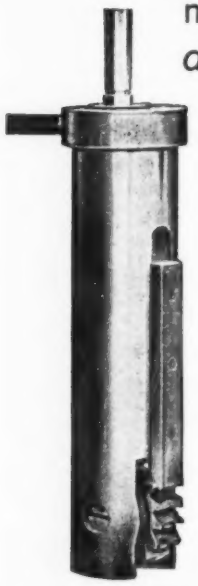

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Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Weldon Tool Co., Cleveland

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Adams Co., Dubuque, Iowa
Bantam Bearings Corp., S. Bend, Ind.
Barber-Colman Co., Rockford, Ill.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
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Standard Tool Co., Cleveland
Stow Mfg. Co., Binghamton, N. Y.
Taylor Machine Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Waltham Mach. Wks., Waltham, Mass.

CUTTERS, Hand Pipe (See STOCKS, DIES & CUTTERS, Pipe)

CUTTERS, Keyseater
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Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., Detroit
Davis Keyseater Co., Rochester, N. Y.
Ex-Cell-O Corp., Detroit
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Mitts & Merrill, Saginaw, Mich.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Machine Tool Co., Cincinnati
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co. Hartford, Conn.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

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Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
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Cleveland Twist Drill Co., Cleveland
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gorton Mach. Co., George, Racine, Wis.
Grayson Mfg. Co., Monrovia, Calif.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Kearney & Treacker Corp., Milwaukee
Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Tool Corp., Meadville, Pa.
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Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
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Scully-Jones & Co., Chicago
Severance Tool Mfg. Co., Saginaw, Mich. (Midget)
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Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Waltham Mach. Wks., Waltham, Mass.
Weldon Tool Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
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deSanno & Sons, Inc., A. P., Philadelphia
Porter McLeod Machine Tool Co., Inc., Hatfield, Mass.
Racine Tool & Mach. Co., Racine, Wis.

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Clearing Machine Corp., Chicago
Curtis Pneu. Machinery Co., St. Louis
Hanna Engrg. Wks, Chicago
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DEGREASERS (See Metal Cleaning Equipment)

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Blanchard Mach. Co., Cambridge, Mass.
L-W Chuck Co., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

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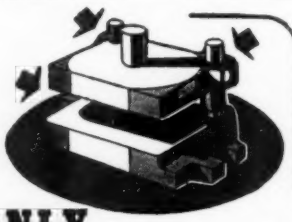
Crafts Co., Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Smit & Sons, Inc., J. K., N. Y. C.

DIE-CASTING MACHINES
Continental Machines, Inc., Minneapolis
Reed-Prentice Corp., Worcester, Mass.



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Pratt & Whitney Div. Niles-Bemont-Pond Co., Hartford, Conn.
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Noble & Westbrook Mfg. Co., East Hartford, Conn

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Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
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National Acme Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Brothers Co., Wrentham, Mass.

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Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Consolidated Machine Tool Corp., Rochester, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Warner & Swasey Co., Cleveland
Winter Brothers Co., Wrentham, Mass.

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V & O Press Co., Hudson, N. Y.
Waltham Mach. Works, Waltham, Mass.

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Illinois Tool Works, Chicago
Metal Carbides Corp., Youngstown, O
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vaseloy-Ramet Corp., N. Chicago, Ill.

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DISKS, Circular Cutting
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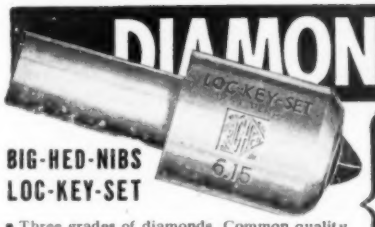

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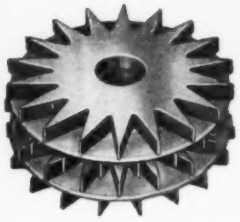

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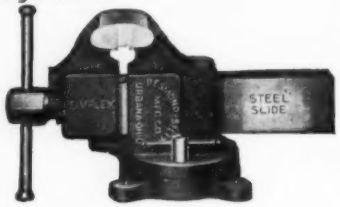

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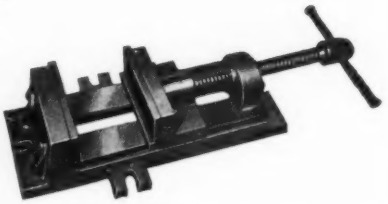

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Victor Machinery Exchange, N. Y. C.

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I & S Tool Co., E. Orange, N. J.
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Houghton & Co., E. F., Philadelphia
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White & Bagley, Worcester, Mass.

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Standard Tool Co., Cleveland

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Schauer Mach. Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

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Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

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Gairing Tool Co., Detroit
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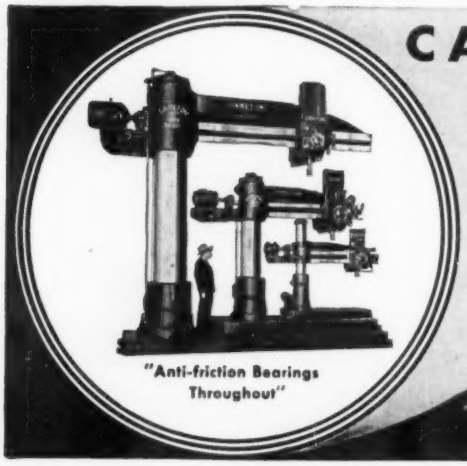

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DRILLS, Hand (See Tools, Hand)

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Ryerson & Son, Jos. T., Chicago
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Universal Boring Mach. Co., Hudson, Mass.

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Fosdick Machine Tool Co., Cincinnati
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Scherr Co., Geo., N. Y. C.
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DRILLS, Portable Pneumatic (See TOOLS, Portable Pneumatic)

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Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Kingsbury Mach. Tool Corp., Keene, N. H.
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Pratt & Whitney Div. Niles-Bement-Pond Co. Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

DRIVES, Machine
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Dayton Rubber Mfg. Co., Dayton, O.
Drive-All Mfg. Co., Detroit
General Electric Co., Schenectady, N. Y.
Hardings Brothers, Inc., Elmira, N. Y.
Reed-Prentice Co., Worcester, Mass.
Reliance Elec & Engrg Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Sheldon Mach. Co., Chicago
Turner Machinery Co., Kansas City, Mo.

DRIVES, Variable-Speed (See TRANSMISSIONS, Variable-Speed)

DRIVES, "V"-Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Colo.

DRIVES, Worm
Adams Company, Dubuque, Iowa
Bilgram Gear & Mach. Wks., Philadelphia
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Earle Gear & Mach Co., Philadelphia
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
Grant Gear Works, Boston
Michigan Tool Co., Detroit
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia

DRYING Machines (See MACHINES, Washing and Drying)

DUPLICATORS, Pontographs
Detroit Universal Duplicator Co., Detroit

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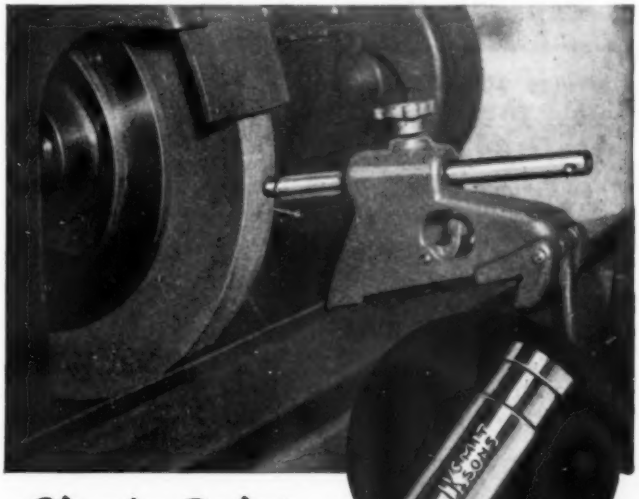

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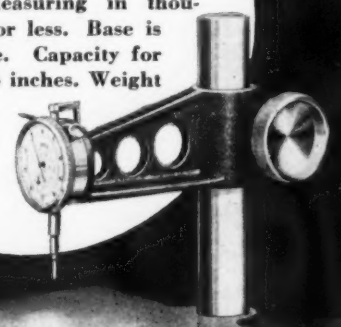

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Roebling's Sons Co., John A., Trenton, N. J.
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Barrett Co., Leon J., Worcester, Mass.

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Reed-Prentice Co., Worcester, Mass.

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Gorton Machine Co., Geo., Racine, Wis.

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EXTRACTORS, Screw
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Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach Co., New Bedford, Mass.
Standard Tool Co., Cleveland

FANS, Man-Cooler (See BLOWERS)

FEEDS, Die (See FEEDS, Press)

FEEDS, Hydraulic
Ex-Cell-O Tool Corp., Detroit
Hydraulic Press Mfg. Co., Mt. Gilead, O.
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Vickers, Inc., Detroit

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Federal Press Co., Elkhart, Ind.
Henry & Wright Mfg. Co., Hartford, Conn.
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Producto Machine Co., Bridgeport, Conn.
Schrader's Sons, A., N. Y. C.
V. & O. Press Co., Hudson, N. Y.
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Stow Mfg. Co., Inc., Binghamton, N. Y.
Strand & Co., N. A., Chicago

FILES, Rotary
Disston & Sons, Inc., Henry, Philadelphia
Hamilton Tool Co., Hamilton, O.
Strand & Co., N. A., Chicago

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Ames Co., B. C., Waltham, Mass.
Continental Machines Inc., Milwaukee
Do All Co., Inc., Des Plaines, Ill.
Illinois Tool Co., Chicago
Oliver Instrument Co., Adrian, Mich.

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Cleveland Pneu. Tool Co., Cleveland
Curtis Pneu. Machy. Co., St. Louis
Norton Company, Worcester, Mass.

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Eastern Machine Screw Corp., New Haven, Conn.
Hardinge Brothers, Inc., Elmira, N. Y.
Mitts & Merrill, Saginaw, Mich.
Rivett Lathe & Grinder, Inc., Boston

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Watson-Stillman Co., Roselle, N. J

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American Steel & Wire Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland
Roebling's Sons Co., John A., Trenton, N. J.

FIXTURES, Indexing
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Hartford Special Machinery Co., Hartford, Conn.
Jefferson Mach. Tool Co., Cincinnati

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Air Reduction, N. Y. C.
Oster Mfg. Co., Cleveland

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Morris Ltd., B. O. Birmingham, Eng.
Strand Mfg. Co., N. A., Chicago

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Atkins & Co., E. C. Indianapolis
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FLUX & SOLDER
Electric Welding Alloys Inc., N. Y. C.

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FORGING MACHINES (See also Presses, Forging)
Ajax Mfg. Co., Euclid, Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Hill Acme Co., Cleveland

FORGINGS (See Contract Work)

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Cleveland Punch & Shear Wks., Cleveland
Consolidated Mach. Tool Corp., Rochester, N. Y.
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Farrel-Birmingham Co., Ansonia, Conn.
Henry & Wright Mfg. Co., Hartford,
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Watson-Stillman Co., Roselle, N. J.
Yoder Co., Cleveland
Zeh & Hahnemann Co., Newark, N. J.

FURNACES, Electric
General Electric Co., Schenectady, N. Y.
Lindberg Engrg. Co., Chicago
Surface Combustion Corp., Toledo, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

FURNACES, Gas
American Gas Furn. Co., Elizabeth, N. J.
Chicago Flexible Shaft Co., Chicago
Hones, Inc., Chas. A., Baldwin, N. Y.
Lindberg Engrg. Co., Chicago
Stark Tool Co., Waltham, Mass.
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

FURNACES, Oil
Chicago Flexible Shaft Co., Chicago
Surface Combustion Corp., Toledo

FURNITURE, Shop
Black & Decker Mfg. Co., Towson, Md. (Drill Stands)
Hamilton Tool Co., Hamilton, O.
New Britain-Gridley Machine Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

GAGES, Amplifying
Federal Products Corp., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Van Keuren Co., Watertown, Mass.

GAGES, Caliper
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.

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Sheffield Corp., Dayton, O.
Slocumb Co., J. T., Providence, R. I.
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Taft-Peirce Mfg Co., Woonsocket, R. I.

GAGES, Comparator
American Measuring Instruments Corp., N. Y. C.
Ames Co., B. C., Waltham, Mass.
Federal Products Corp., Providence, R. I.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
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Taft-Peirce Mfg. Co., Woonsocket, R. I.
Continental Machines, Inc., Minneapolis
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

GAGES, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Randall & Stickney, Waltham, Mass.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Drill-Center
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Lufkin Rule Co., Saginaw, Mich.
Morse Twist Drill Co., New Bedford, Mass.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

GAGES, Height
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Lufkin Rule Co., Saginaw, Mich.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

GAGES, Plug & Ring
Brown & Sharpe Mfg Co., Providence, R. I.
Cadillac Gage Co., Detroit
Carboloy Co., Detroit
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Lincoln Park Tool & Gage Co., Lincoln Park, Mich.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Gage Grinding Co., Ferndale, Mich.
Vard Inc., Pasadena, Calif.
Van Keuren Co., Watertown, Mass.

GAGES, Pressure
Baldwin-Southwark Corp., Philadelphia
Brown Instrument Co., Philadelphia

GAGES, Profile
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Snap (See GAGES, Plug & Ring)

GAGES, Surface
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

GAGES, Thickness
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney Co., Waltham, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Mach. Co., Hartford, Conn.
Lufkin Rule Co., Saginaw, Mich.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T. Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

GAGES, Wire
Atkins & Co., E. C., Indianapolis
Brown & Sharpe Mfg. Co., Providence, R. I.
Disston & Sons, Inc., Henry, Philadelphia
Federal Products Corp., Providence, R. I.
Morse Twst Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.

GALVANIZING MACHINES (See ENAMELING & GALVANIZING MACHINES

GASES, Compressed
Air Reduction, N. Y. C.

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Cross Gear & Machine Co., Detroit
Farrell-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
General Mach. Corp., Hamilton, O.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Newark Gear Cutting Mach. Co., Newark
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Waltham Mach. Wks., Waltham, Mass.

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Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
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National Broach & Mach. Co., Detroit
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Scherr Co., Inc., Geo., N. Y. C.

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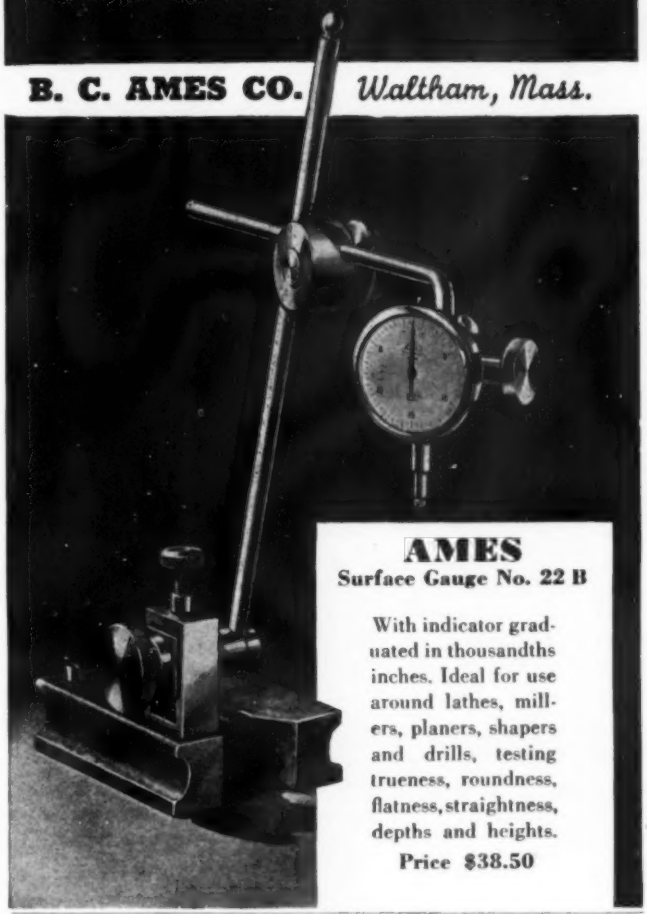

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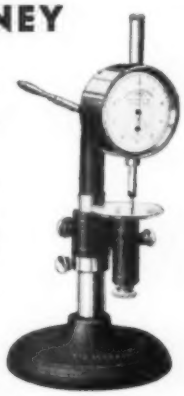

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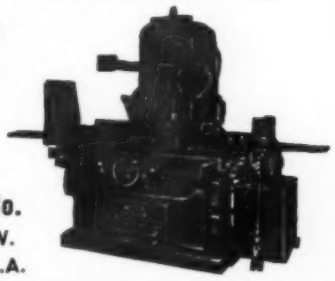

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Earle Gear & Machine Co., Philadelphia
Fairfield Mfg. Co., Lafayette, Ind.
Farrel-Birmingham Co., Buffalo, N Y.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties Inc., Chicago
Gleason Works, Rochester, N. Y.
Grant Gear Works, Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
Meisel Press Mfg. Co., Boston
Michigan Tool Co., Detroit
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Quaker City Gear Wks., Inc., Philadelphia
Sier-Bath Gear Co., North Bergen, N. J.
Stahl Gear & Machine Co., Cleveland

GEARS, Master

Earle Gear & Mach. Co., Philadelphia
Fellows Gear Shaper Co., Springfield, Vt.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Broach & Mach. Co. Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

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Bilgram Gear & Mach. Wks., Philadelphia
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
James Co., D. O., Chicago
Meisel Press Mfg. Co., Boston
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Sier-Bath Gear Co., North Bergen, N. J.
Stahl Gear & Machine Co., Cleveland
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

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American Optical Co., Southbridge, Mass.

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Norton Co., Worcester, Mass.
Sterling Grinding Wheel Div., Tiffin, O.

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Mattison Machine Works, Rockford, Ill.
Mid-West Abrasive Co., Detroit
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

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Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
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Queen City Machine Tool Co., Cincinnati
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Stow Mfg. Co., Binghamton, N. Y
Union Twist Drill Co., Athol, Mass.
Vonnegut Moulder Corp., Indianapolis
Walker Co., O. S., Worcester, Mass.
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

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Norton Co., Worcester, Mass.

GRINDERS, Carbide Tool

Blount Co., J. G., Everett, Mass.
Ex-Cell-O Corp., Detroit
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.

GRINDERS, Centerless

Cincinnati Grinders, Inc., Cincinnati
Heald Machine Co., Worcester, Mass.
Metal Carbides Corp., Youngstown, O.

GRINDERS, Chucking

Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mach. Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDERS, Contour

Baker Bros., Inc., Toledo, Ohio
Blanchard Machine Co., Cambridge, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Cutter & Tool

Abrasive Mach. Tool Co., E. Providence, R. I.
Barber-Colman Co., Rockford, Ill.
Blount Co., J. G., Everett, Mass.
Boggis & Co., H. P., Cleveland
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Carboloy Co., Inc., Detroit
Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
General Machinery Corp., Boston
Geometric Tool Co., New Haven, Conn.
Gorton Machine Co., Geo., Racine, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Kearney & Trecker Co., Milwaukee
Landis Machine Co., Waynesboro, Pa.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
National Acme Co., Cleveland
Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sellers & Co., Inc., Wm., Philadelphia
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Cylindrical

Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Grinders, Inc., Cincinnati
Dumore Co., Racine, Wis.
Farrel-Birmingham Co., Ansonia, Conn.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.

WHERE-TO-BUY DIRECTORY

Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Disk
Delta Mfg. Co., Milwaukee
Fitchburg Gringing Machine Corp. Fitchburg, Mass.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Queen City Mach. Tool Co., Cincinnati
Wall Sales Corp., N. Y. C.

GRINDERS, Drill & Tap
Blake Co., Edward, Newton Center, Mass.
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Sellers & Co., Wm., Philadelphia
Union Twist Drill Co., Athol, Mass.

GRINDERS, Face or Ring Wheel
Abrasive Mach. Tool Co., E. Providence R. I.
Blanchard Machine Co., Cambridge, Mass.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Bickford Tool Co., Oakley, Cincinnati
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.

GRINDERS, Gear
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gear Grinding Machine Co., Detroit
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GRINDERS, Internal
Arter Grinding Mach. Co., Worcester, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Rivett Lathe & Grinder, Inc., Boston
Sav-Way Industries, Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Jig
Moore Spec. Tool Co., Bridgeport, Conn.

GRINDERS, Knife & Shear-Blade
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atkins & Co., E. C., Indianapolis
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hill-Acme Co., Cleveland
Mattison Machine Works, Rockford, Ill.

GRINDERS, Lathe-Attachment (See ATTACHMENTS, Lathe)

GRINDERS, Portable Electric (See also TOOLS, Portable Electric)
Black & Decker Mfg. Co., Towson, Md.
Chicago Wheel & Mfg Co., Chicago
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rotor Tool Co., Cleveland

GRINDERS, Spline
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS, Surface
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atlantic Machinery Co., N. Y. C.
Blanchard Mach. Co., Cambridge, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Gardner Machine Co., Beloit, Wis.
Hammond Machy. Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Hill-Acme Co., Cleveland
Landis Tool Co., Waynesboro, Pa.
Leach Machinery Co., H., Providence, R. I.
Mattison Machine Works, Rockford, Ill.
Murchey Machine & Tool Co., Detroit
Norton Co., Worcester, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Swing-Frame
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jefferson Machine Tool Co., Cincinnati
Vonnegut Moulder Corp., Indianapolis

GRINDERS, Thread
Ex-Cell-O Corp., Detroit
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.

GRINDERS, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Thompson Grinder Co., Springfield, O.

GRINDING, Centerless (See CONTRACT WORK)

GRINDING FIXTURES
Industrial Engrg. Co., Inc., Minneapolis

GROOVERS, Oil
Hanson-Whitney Mach. Co., Hartford, Conn.
National Machine Tool Co., Cincinnati

GUARDS & SAFETY APPLIANCES, Machinery
Littleford Bros., Cincinnati
Schrader's Son, A., Brooklyn, N. Y.

HACK SAW BLADE GRINDING FIXTURES (See GRINDING FIXTURES)

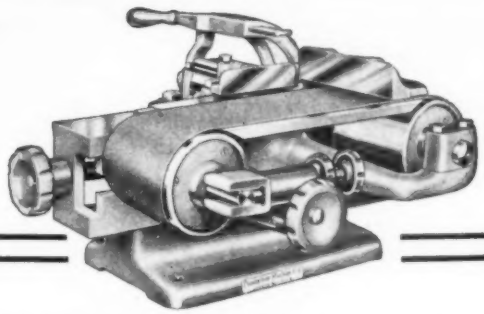
HAMMERS, Drop
Farrel-Birmingham Co., Ansonia, Conn.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

HAMMERS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.
Cleveland Pneu. Tool Co., Cleveland

HAMMERS, Power
General Machinery Corp., Hamilton, O.
Sellers & Co., Wm., Philadelphia

HAMMERS, Softfaced
Greene, Tweed & Co., N. Y. C.
Johnson Tool Co., Inc., E. Providence, R. I.

HANDLES, Crank & Machine
Machine Products Corp., Detroit
Williams & Co., J. H., Buffalo, N. Y.



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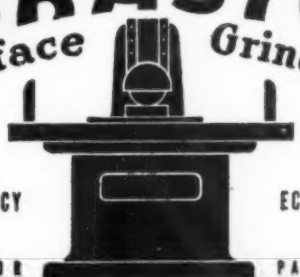

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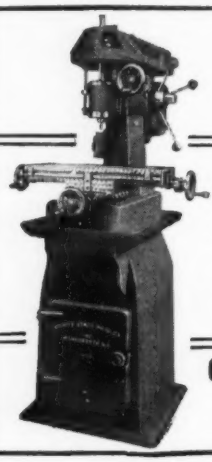

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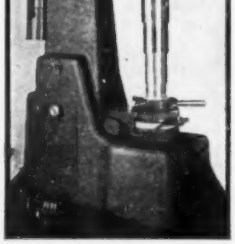

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HANGERS, Shaft
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn
Hill-Acme Co., Cleveland
Morse Chain Co., Ithaca, N. Y.
S.K.F. Industries, Inc., Philadelphia

HARDENING MACHINES, Flame
Air Reduction, N. Y. C.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt
Gleason Works, Rochester, N. Y.

HEADERS, Rivet
Grant Mfg. & Mach. Co., Bridgeport Conn.
Hill-Acme Co., Cleveland
Tomkins-Johnson Co., Jackson, Mich.

HEADS, Boring
Bullard Co., Bridgeport, Conn.
Carboloy Co., Inc., Detroit
Criterion Mach. Wks., Beverly Hills, Cal
Elmes Engrg. Wks., Chas. F., Chicago
Fray Machine Tool Co., Glendale, Calif
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Lovejoy Tool Co., Inc., Springfield, Vt
Rickert-Shafer Co., Erie, Pa.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I

HEADS, Dividing
Brown & Sharpe Mfg. Co., Providence R. I.
Cincinnati Milling Mach. Co., Cincinnati
Hartford Special Machry. Co., Hartford Conn.
Jefferson Mach. Tool Co., Cincinnati
L-W Chuck Co., Toledo, O.
Scherr Co., Geo., N. Y. C.

HEADS, Drilling
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Errington Mech. Lab., Stapleton, N. Y.
Etteo Tool Co., Brooklyn, N. Y.
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., Detroit

HEADS, Grinding
Ex-Cell-O Corp., Detroit
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Machine Co., Waynesboro, Pa.

HEADS, Milling
Cincinnati Milling Mach. Co., Cincinnati
Kempsmith Machine Co., Milwaukee

HEADS, Tapping
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Bradford Mach. Tool Co., Cincinnati
Cross Gear & Machine Co., Detroit
Errington Mech. Lab., Stapleton, N. Y.
Etteo Tool Co., Brooklyn, N. Y.
Foote-Burt Co., Cleveland
Greenlee Bros & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
National Auto. Tool Co., Richmond, Ind.

HEATERS, Rivet
American Gas Furnace Co., Elizabeth, N. J.
General Electric Co., Schenectady, N. Y.

HEATERS, Unit
Buffalo Forge Co., Buffalo, N. Y.
Surface Combustion Corp., Toledo, O.
Wiedemann Machine Co., Philadelphia

HELMETS & SHIELDS, Welding
Air Reduction, N. Y. C.
American Optical Co., Southbridge, Mass.
Harnischfeger Corp., Milwaukee
Hobart Bros., Co., Troy, O.
Lincoln Electric Co., Cleveland

HOBBERS, Gear
Adams Co., Dubuque, Iowa.
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Hall Planetary Co., Philadelphia
Lees-Bradner Co., Cleveland
Scherr Co., Geo., N. Y. C.

HOBS
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Mach. Co., Hartford, Conn.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

HOISTS, Chain
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Ford Chain Block Div., Am. Chain & Cable Co., Philadelphia
Wright Mfg. Div. of Am. Chain Cable Co., York, Pa.

HOISTS, Electric
Allis-Chalmers Mfg. Co., Milwaukee
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Harnischfeger Corp., Milwaukee
Philadelphia Gear Works, Philadelphia
Wright Mfg. Div., Amer. Chain & Cable Co., York, Pa.

HOISTS, Pneumatic
Curtis Pneumatic Machy. Co., St. Louis
Tomkins-Johnson Co., Jackson, Mich.

HOLDERS, Tool
Armstrong Bros. Tool Co., Chicago
Auto Ordnance Corp., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Sturdimatic Tool Co., Detroit
Weldon Tool Co., Cleveland
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

HONES & HONING MACHINES
Automotive Maintenance Machy. Co., No. Chicago, Ill.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F., & John, Rockford, Ill.
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Micromatic Hone Corp., Detroit
Midwest Abrasive Co., Detroit
Norton Co., Worcester, Mass.
Sunnen Products Co., St. Louis, Mo.

HOOKS, Hoist
Kropp Forge Co., Chicago
Williams & Co., J. H., Buffalo, N. Y.

HOSE, Flexible Metal
Chicago Metal Hose Corp., Maywood, Ill.

HOSE, Rubber
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Colo.

HYDRAULIC EQUIPMENT
Denison Engineering Co., Columbus, Ohio
Ex-Cell-O Corp., Detroit
Hydraulic Machinery Inc., Detroit
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lempco Products, Inc., Bedford, O.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.

INDEXING FIXTURES (see FIXTURES, Indexing)

INDICATORS, Dial (See GAGES, Dial)

INDICATORS, Speed
Brown & Sharpe Mfg. Co., Providence, R. I.

WHERE-TO-BUY DIRECTORY

Brown Instrument Co., Philadelphia
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

INDICATORS, Temperature
Brown Instrument Co., Philadelphia

INSTRUMENTS, Hardness-Measuring
Shore Inst & Mfg. Co., Jamaica, N. Y
Wilson Mechanical Inst. Co., N. Y. C.

INSTRUMENTS, Optical Inspection
Jones & Lamson Mach. Co., Springfield, Vt.
Vard Inc., Pasadena, Calif.

JACKS, Machinist's
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

JAWS, Boring Mill
Horton & Son Co., E. Windsor Locks, Conn.

JIG-BORING MACHINES
Baker Bros., Inc., Toledo, O.
Cincinnati Bickford Tool Co., Cincinnati
Fosdick Machine Tool Co., Cincinnati
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Kearney & Trecker Products Corp., Milwaukee, Wis.
Knight Machinery Co., W. B., St. Louis
Linley Brothers Co., Bridgeport, Conn.
Machinery Mfg. Co., Los Angeles
Moore Special Tool Co., Inc., Bridgeport, Conn.
Pratt & Whitney Co., Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.

JIGS & FIXTURES (See CONTRACT WORK)

JOINTS, Universal
Baush Mach. Tool Co., Springfield, Mass.
Mollart Engrg. Co., Ltd., Surrey, Eng.
National Auto. Tool Co., Richmond, Ind.
Philadelphia Gear Works, Philadelphia

KEYSEATERS
American Broach & Mach. Co., Ann Arbor, Mich.
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis Keyseater Co., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Mitts & Merrill, Saginaw, Mich.
National Machine Tool Co., Cincinnati
Reed-Prentice Corp., Worcester, Mass.

KNIVES, Shear
Atkins & Co., E. C., Indianapolis
Cincinnati Shaper Co., Cincinnati
Cleveland Punch & Shear Works Co., Cleveland
Colonial Broach Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Haynes Stellite Co., N. Y. C.
Michigan Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.

KNURLS & KNURL HOLDERS
American Swiss File & Tool Co., Elizabeth, N. J.
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

LABELS
Ever Ready Label Corp., N. Y. C.

LAPPERS, Centerless
Cincinnati Grinders, Inc., Cincinnati
Ex-Cell-O Corp., Detroit
Production Mach. Co., Greenfield, Mass.
Ultra-Lap Mach. Co., Detroit

LAPPERS, Cylindrical & Flat
Automotive Maintenance Machy. Co., No. Chicago, Ill.
Ex-Cell-O Corp., Detroit
Mid-West Abrasive Co., Detroit
Moline Tool Co., Moline, Ill.
Norton Co., Worcester, Mass.
Sellers & Co., Inc., Wm., Philadelphia
Ultra-Lap Mach. Co., Detroit

LAPPERS, Gear
American Tool Works Co., Cincinnati
Colonial Broach Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Ultra-Lap Mach. Co., Detroit

LAPS, Toolmaker's
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Producto Mach. Co., Bridgeport, Conn.
Starrett & Co., L. S., Athol Mass.
Ultra-Lap Mach. Co., Detroit

LATHE PANS
Littleford Bros., Cincinnati

LATHES, Automatic & Semi-Automatic
Bullard Co., Bridgeport, Conn.
Cleveland Auto. Mach. Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Goss & deLeeuw Machine Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Kingsbury Mach. Tool Corp., Keene, N. H.
LeBlond Mach. Tool Co., R. K., Cincinnati
Lipe-Rollway Corp., Syracuse, N. Y.
Lodge & Shipley Mach. Tool Co., Cincinnati
Monarch Machine Tool Co., Sidney, O.
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Porter Cable Mach. Co., Syracuse, N. Y.
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rockford Mach. Tool Co., Rockford, Ill.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Smallpeice, Ltd., Beverly, Mass.
Snyder Tool & Engrg. Co., Detroit
Sunstrand Mach. Tool Co., Rockford, Ill.
Warner & Swasey Co., Cleveland
Wickman Corp., Detroit

LATHES, Bench
Ames Co., B. C., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Blount Co., J. G., Everett, Mass.
Bradford Machine Tool Co., Cincinnati
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
LeBlond Mach. Tool Co., R. K., Cincinnati
Logan Engineering Co., Chicago
Pratt & Whitney Div., Niles- Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Schauer Machine Co., Cincinnati
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Sheldon Machine Co., Chicago
Sidney Machine Tool Co., Sidney, O.
South Bend Lathe Works, S. Bend, Ind.
Stark Tool Co., Waltham, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.
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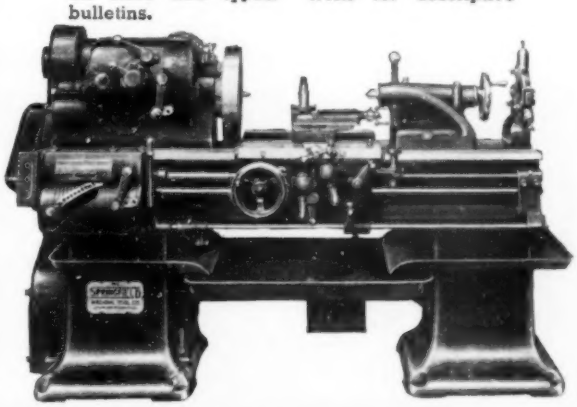

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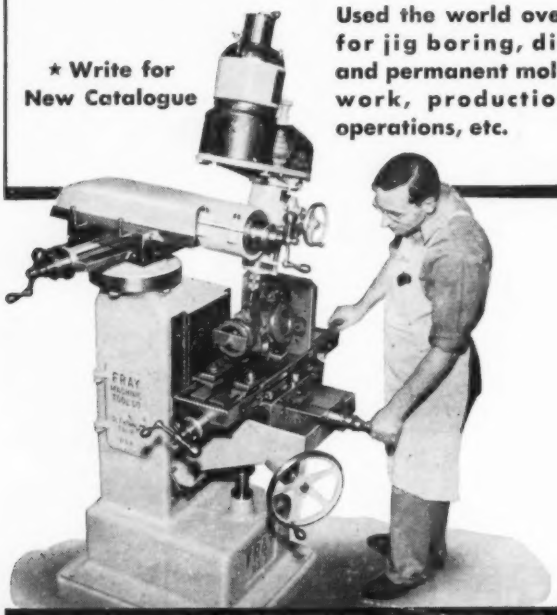

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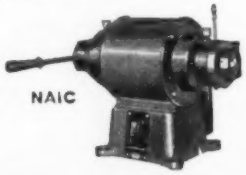

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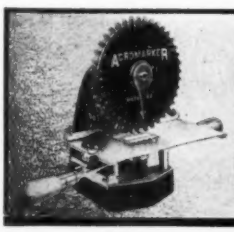

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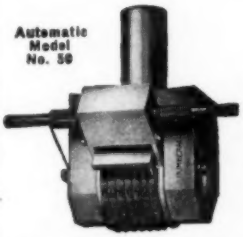

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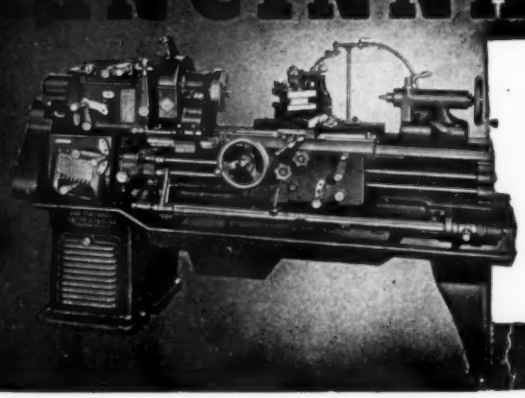

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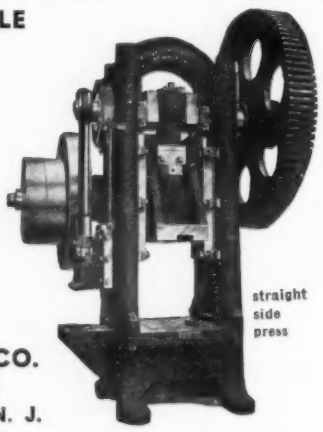

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General Machinery Corp., Hamilton, O.
Ohio Machine Tool Co., Kenton, O.
Sellers & Co., Wm., Philadelphia

PLATES, Angle
Brown & Sharpe Mfg. Co., Providence, R. I.
Lombard Governor Corp., Ashland, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Smith Tool & Engrg. Co., Bucyrus, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

PLATES, Surface
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Delta Mfg. Co., Milwaukee
Lombard Governor Corp., Ashland, Mass.
Machine Products Corp., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Smith Tool & Engrg. Co., Bucyrus, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

PLATFORMS, SKID (See TRUCKS, Hand Lift)

PLATING, Brass, Chromium, Copper
Chromium Corp. of Amer., N. Y. C.
Industrial Chromium Corp., Holyoke, Mass.

PLATING, Spot
Industrial Chromium Corp., Holyoke, Mass.

POTENTIOMETERS
Brown Instrument Co., Philadelphia
General Electric Co., Schenectady, N. Y.

POTS, Melting
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General Electric Co., Schenectady, N. Y.
Hones, Inc., Chas. A., Baldwin, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

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Atlas Press Co., Kalamazoo, Mich.
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Famco Machine Co., Racine, Wis.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lempco Products, Inc., Bedford, O.
Lucas Machine Tool Co., Cleveland
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Producto Machine Co., Bridgeport, Conn.
Sheldon Machine Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Buffalo, N. Y.
Wright Mfg. Div., American Chain & Cable Co., York, Pa.

PRESSES, Crank (See PRESSES, Power)

PRESSES, Foot
Etna Machine Co., Toledo, O.
Famco Machine Co., Racine, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Mach. Co., A. H., Bridgeport, Conn.
V. & O. Press Co., Hudson, N. Y.

PRESSES, Forging
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Beatty Mach. & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Machine Corp., Chicago
Cleveland Punch & Shear Works Co., Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Hill Acme Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., Newark, N. J.

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American Broach & Machine Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Machine Corp., Chicago
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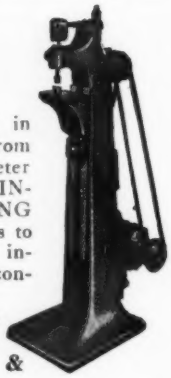

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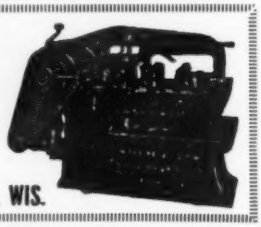

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Morse Twist Drill & Mach. Co., New Bedword, Mass.
Nilson Mach. Co., A. H., Bridgeport, Conn.
Springfield Mach. Tool Co., Springfield, O.
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Tomkins-Johnson Co., Jackson, Mich.

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Rivett Lathe & Grinder, Inc., Boston
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RASPS (See FILES & RASPS)

RATCHETS (See GEARS, Cut)

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Card Mfg. Co., S. W., Mansfield, Mass.
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Greenfield Tap & Die Corp., Greenfield, Mass.
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Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
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Morse Tool Co., Detroit
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Illinois Tool Works, Chicago
LeBlond Mach. Tool Co., R. K., Cincinnati
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

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Grant Mfg. & Mach. Co., Bridgeport, Conn.
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Watson-Stillman Co., Roselle, N. J.

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Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works Co., Cleveland
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Mattison Machine Works, Rockford, Ill.
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SAWS, Friction
Ryerson & Son, Inc., Jos. T., Chicago

SAWS, Hack (See **TOOLS, Hand**)

SAWS, Hole
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SAWS, Power Hack
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SCRAPERS, Power
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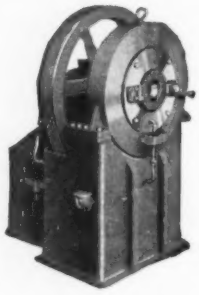

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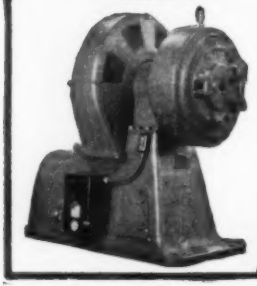

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Producto Machine Co., Bridgeport, Conn.
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Cone Automatic Mach. Co., Windsor, Vt.
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Greenlee Bros. & Co., Rockford, Ill.
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Scherr Co., Inc., George, N. Y. C.
Warner & Swasey Co., Cleveland

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Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y
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National Acme Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Warner & Swasey Co., Cleveland

SCREW PLATES (See **DIES, Screw-Cutting, Adjustable**)

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Baumbach Mfg. Co., E. A., Chicago
Danly Machine Specialties, Inc., Chicago
Detroit Die Set Corp., Detroit
Eastern Machine Screw Corp., New Haven, Conn.
National Acme Co., Cleveland
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong Carlisle & Hammond Co., Cleveland

SCREWS, Machine
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Eastern Machine Screw Corp., New Haven, Conn.
Lamson & Sessions Co., Cleveland
Republic Steel Co., Cleveland
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Recessed Head
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Central Screw Co., Chicago
Chandler Products Corp., Cleveland
Continental Screw Co., New Bedford Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit
National Screw & Mfg. Co., Cleveland
New England Screw Co., Keene, N. H.
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Corp., N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago, Ill.
Phillips Screw Mfrs., Providence, R. I.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago
Southington Hardware Mfg. Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, Self-Tapping
Parker-Kalon Corp., N. Y. C.

SCREWS, Thumb & Wing
Parker-Kalon Corp., N. Y. C.

SCRIBERS
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Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

SEPARATORS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
National Acme Co., Cleveland

SETS, Rivet
American Swiss File & Tool Co., Elizabeth, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland

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SHAFTING, Steel
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Earle Gear & Mach. Co., Philadelphia
Jones & Laughlin Steel Corp., Pittsburgh
National Tube Co., Pittsburgh
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Union Drawn Steel Co., Massillon, O.
Wyckoff Drawn Steel Co., Pittsburgh

SHAFTS, Flexible
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Errington Mech. Lab., Stapleton, N. Y.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Inc., Plainfield, N. J.

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Ames Co., B. C., Waltham, Mass.
Atkins & Co., E. C., Indianapolis
Atlas Press Co., Kalamazoo, Mich.
Automotive Maintenance Machinery Co., N. Chicago, Ill.
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Hanson-Whitney Mach. Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Machinery Mfg. Co., Los Angeles
Morey Machinery Co., Inc., N. Y. C.
Ohio Machine Tool Co., Kenton, O.
Pratt & Whitney Div., Niles-Bement-Bond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rockford Mach. Tool Co., Rockford, Ill.
Smith & Mills Co., Cincinnati

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Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Weldon Tool Co., Cleveland

SHAVING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Michigan Tool Co., Detroit

SHEARS, Hand
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Minneapolis

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Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Sons, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEARS, Squaring
Beatty Mach. & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Kent-Owens Machine Co., Toledo, O.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wkks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEAVES, "V" Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Dodge Mfg. Corp., Mishawaka, Ind.
Earle Gear & Machine Co., Philadelphia
Gates Rubber Co., Denver, Colo.
Hill Acme Co., Cleveland

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SHEET-METAL WORKING MACHINERY (See **BRAKES, Bending Press; DIES, Sheet-Metal; Forming Machines; NIBBLERS; PRESSES; REELS, Strip-stock; RIVETERS; ROLLS, Bending; SHEARS; STITCHERS, Metal**)

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Colman & Sons, Frederick, Detroit
Hepburn American Co., Greenwich, Conn.
Morey Machinery Co., Inc., N. Y. C.

SHIMS, Bearing, Plain & Laminated
Laminated Shim Co., Glenbrook, Conn.

SHIPPING BAGS
Ames Bag Co., Cleveland

SHIPPING SERVICE
Railway Express, All Principal Cities

SKIDS (See **TRUCKS, Hand**)

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Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Brothers, Inc., Elmira, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

SLOTTERS
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Consolidated Machine Tool Corp., Rochester, N. Y.
Douglas Machinery Co., Inc., N. Y. C.
General Machinery Corp., Hamilton, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

SOCKETS, Drill (See **SLEEVES & SOCKETS, Drill**)

SOLVENTS, Oil & Grease
Detroit Rex Products Co., Detroit
Oakite Products, Inc., N. Y. C.

SPINDLES, Machine
Bryant Chucking Grinder Co., Springfield, Vt.
Dumore Co., Racine, Wis.
Ex-Cell-O Corp., Detroit
Heald Machine Co., Worcester, Mass.
Monarch Machine Tool Co., Sidney, O.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago

SPRINGS, Die
Allen Mfg. Co., Hartford, Conn.
Danly Machine Specialties, Chicago
Detroit Die Set Corp., Detroit

SPROCKETS (See **GEARS, CUT**)

SQUARES, Precision (See **BLOCKS, Precision Gage**)

STAMPINGS, Metal
Acromark Corp., Elizabeth, N. J.
American Brass Co., Waterbury, Conn.
Continental Machines, Inc., Minneapolis
Revere Copper & Brass Inc., N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.
Sundstrand Mach. Tool Co., Rockford, Ill.

STAMPS & HOLDERS, Steel, Safety
Acromark Corp., Elizabeth, N. J.
Cunningham Co., M. E., Pittsburgh
Noble & Westbrook Mfg. Co., East Hartford, Conn.

STAMPS, Steel (See **DIES, Marking & Embossing**)

STARTERS, Motor (See **CONTROLLERS, Motor**)

STEEL, Die
Allegheny Ludlum Steel Corp., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube, Div., Canton, O.
Vanadium Alloys Steel Co., Pittsburgh

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Bissett Steel Co., Cleveland (Tubing)
Boker & Co., Inc., H., N. Y. C.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Jones & Laughlin Steel Corp., Pittsburgh
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
Union Drawn Steel Co., Massillon, O. (Cold-finished)
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, Stainless (See preceding classification)

STEEL, Tool
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Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Climax Molybdenum Co., N. Y. C.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Crobalt Inc., Ann Arbor, Mich.
Firth-Sterling Steel Co., Mc Keesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
United States Steel Corp., Pittsburgh
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy Co., Inc., Cambridge, Mass.

STERILIZERS, Oil
Barrett Co., Leon J., Worcester, Mass.

STOCKS, Dies & Cutters, Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Tool Co., Cleveland
Winter Brothers Co., Wrentham, Mass.

STONES, Sharpening
Bay State Abrasive Products Co., Westboro, Mass.
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Midwest Abrasive Co., Detroit

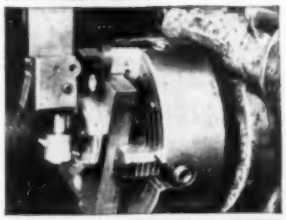
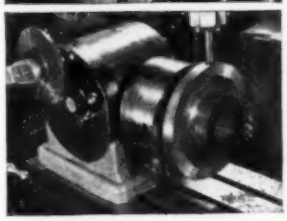
STRAIGHTEDGES (See **DIE-MAKERS' SUPPLIES**)

STRAIGHTENERS, Wire
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

STRAIGHTENING & SIZING MACHINES
Taylor Wilson Mfg. Co., McKees Rocks, Pa.

SUB-PRESSES & DIES (See Dies, Sub-press)

SUPERFINISHING EQUIPMENT
Ultra-Lap Mach. Co., Detroit

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(a) Left: Set-up for cutting a spline in an adapter

(b) Below: Set-up for cutting an internal gear

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Detroit, Michigan

(c) Below: Conventional set-up on a round over-arm milling machine—thumbnail shows a set-up for shaping a feed cam.

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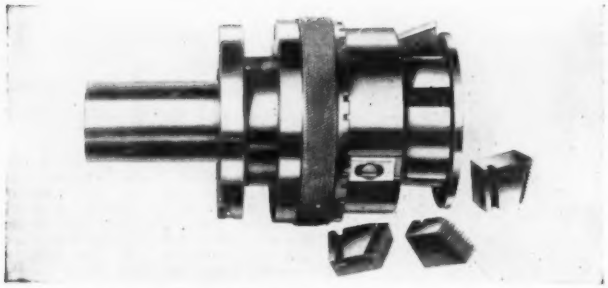

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SPECIAL THREADING MACHINES

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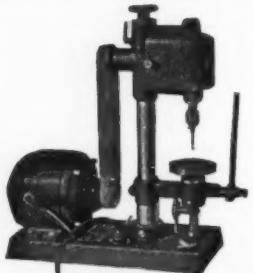

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HAMILTON OHIO

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Torrington Co., Torrington, Conn.

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Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
L-W Chuck Co., Toledo, O.
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SWITCHES, Limit
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Barber-Colman Co., Rockford, Ill.
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
Monitor Controller Co., Baltimore, Md.
National Acme Co., Cleveland
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SYSTEMS, Production & Tool Control
McCaskey Register Co., Alliance, O.

TABLES, Elevating Portable
Hamilton Tool Co., Hamilton, O.

TACHOMETERS (See INDICATORS, Speed)

TANKS & CYLINDERS, Air
Anker Holth Mfg. Co. (Airgrip Chuck Div.) Port Huron, Mich.
Clearing Machine Corp., Chicago
Curtis Pneu. Machinery Co., St., Louis
National Tube Co., Pittsburgh
Tomkins-Johnson Co., Jackson, Mich.

TAPER PINS (See PINS, Dowel & Taper)

TAPES, Measuring
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Starrett Co., L. S., Athol, Mass.

TAPPERS, Single & Multi-Spindle
Armstrong-Blum Mfg. Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barber-Colman Co., Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bodine Corp., Bridgeport, Conn.
Bradford Mach. Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati-Gilbert Machine Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Ettco Tool Co., Brooklyn, N. Y.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Haskins Co., R. G. Chicago
Hill Acme Co., Cleveland
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Auto Tool Co., Richmond, Ind.
Rickert-Shafer Co., Erie, Pa.
Snyder Tool & Engrg. Co., Detroit

TAPS, Adjustable (See DIES, Adjustable)

TAPS, Hand & Machine, Solid
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Detroit Tap & Tool Co., Detroit
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Winter Brothers Co., Wrentham, Mass.
Wood & Spencer Co., Cleveland

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Hartford Special Machinery Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.

THREADING MACHINES, Die-Head
Brown & Sharpe Mfg. Co., Providence, R. I.
Dalzen Tool & Mfg. Co., Detroit
Eastern Mach. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., Detroit
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Lees-Bradner Co., Cleveland
Murchey Machine & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Mach. Wks., Waltham, Mass.
Warner & Swasey Co., Cleveland

THREADING MACHINES, Roll
Brown & Sharpe Mfg. Co., Privodence, R. I.
Hill Acme Co., Cleveland
V. & O. Press Co., Hudson, N. Y.

THERMOMETERS, Dial
Brown Instrument Co., Philadelphia
Strong, Carlisle & Hammond Co., Cleveland

TOOL HOLDERS (See HOLDERS, Tool)

TOOL POSTS, Lathe
Armstrong Bros. Tool Co., Chicago
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Boring
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Carboloy Co., Detroit, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Heald Machine Co., Worcester, Mass
Illinois Tool Works, Chicago
Lucas Machine Tool Co., Cleveland
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vaseloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Burring
Nobur Mfg. Co., Los Angeles

TOOLS and PARTS, Cemented-Carbide
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Carboloy Co., Inc., Detroit
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Disston and Sons, Inc., Henry, Tacony Philadelphia

WHERE-TO-BUY DIRECTORY

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Gairing Tool Co., Detroit
Grayson Mfg. Co., Monrovia, Cal.
Illinois Tool Works, Chicago
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Sheffield Corp., Dayton, O.
Tungsten Elec. Corp., Union City, N. J.
Vanadium Alloys Steel Co., Pittsburgh
Vascoloy-Ramet Corp., Chicago
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Diamond-Tipped
Crafts Co., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Gorton Machine Co., Geo., Racine, Wis.
Kent-Owens Machine Co., Toledo, O.
Norton Company, Worcester, Mass.
Smit & Son, J. K., N. Y. C.

TOOLS, Flexible-Shaft
Dumore Co., Racine, Wis.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Walker-Turner, Inc., Plainfield, N. J.

TOOLS, Hand
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Gairing Tool Co., Detroit
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Producto Mach. Co., Bridgeport, Conn.
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Slocomb Co., J. T., Providence, R. I.
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Union Twist Drill Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.
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Sturdimatic Tool Co., Detroit
Vascoloy-Ramet Corp., N. Chicago, Ill.
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Williams & Co., J. H., Buffalo, N. Y.

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Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
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Rotor Tool Co., Cleveland
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Skilsaw, Inc., Chicago
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Sheldon Machine Co., Chicago

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Haynes, Stellite Co., N. Y. C.

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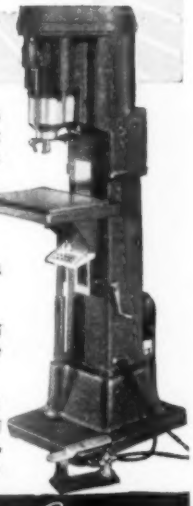

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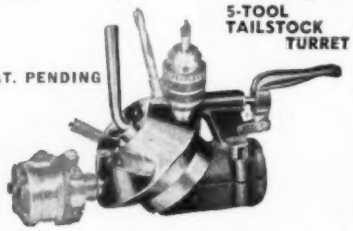

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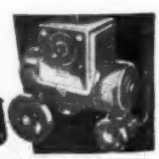

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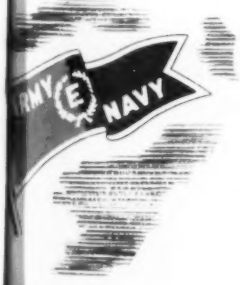

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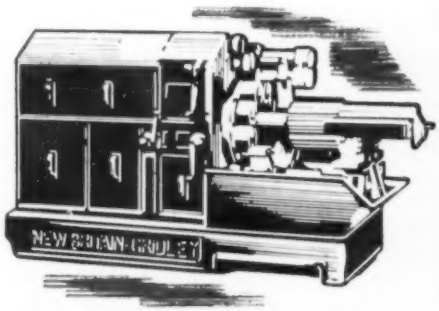

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Graph-Tung	Water or Brine	Medium	Easy Machining Long Wearing Resists Extreme Abrasion
Graph-Al	Water	Shallow	Easy Machining Long Wearing Resists Impact
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